TECHNOLOGY REVIEW

July 1955

Tuesday night, September 28th: the Lummus initial operating team first fed oil into the crude unit of the 30,000 B/D refinery which Lummus designed, engineered and constructed for a major oil company at Mandan, North Dakota.

Wednesday night, September 29th: oil was fed into the fluid catalytic cracking unit.

Friday night, October 1st: the entire refinery was in operation at two-thirds capacity, with products going to storage.

Mandan refinery starts up in three days

The Mandan refinery was completed ahead of schedule, started up in record time, and has been operating ever since. It is an integrated plant including crude distillation section, fluid catalytic cracking unit, vapor recovery section, polymerization unit, treating and blending sections and desalter.

The owner has expressed pleasure and enthusiasm over the excellent time and performance records on the installation, made possible through painstaking engineering and construction efforts.

This adds one more to the over 700 efficiently engineered and constructed projects which Lummus has brought to completion over the past 50 years. May we work with you on your next project.

The Lummus Company, 385 Madison Avenue, New York 17, N. Y. **Engineering & Sales Offices:** New York, Houston, Montreal, London, Paris, The Hague. **Sales Offices:** Chicago, Caracas. **Heat Exchanger Plant:** Honesdale, Pa. **Fabricated Piping Plant:** East Chicago, Indiana.

LUMMUS

DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

Ready for the Rope?

Don't give up! Here's all you need in order to get the whole story of how these MPB's

BALL BEARINGS ACTUAL SIZE

are solving problems in the design of precision instruments

CUT THE CALAMITY AND CUT OUT THE COUPON

Miniature Precision Bearings, Inc., 12 Precision Park, Keene, N. H.

YES! Please send me the reprint of the article, MINIATURE BALL BEARINGS FOR PRECISION INSTRUMENTS

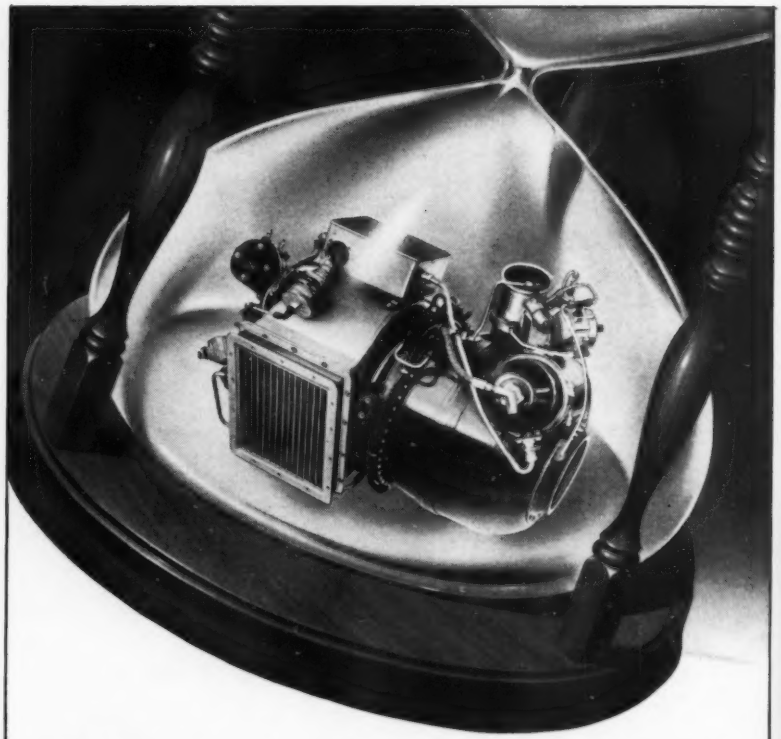
name title company

street city zone state

MINIATURE PRECISION BEARINGS, INC., KEENE, N. H.

THE TECHNOLOGY REVIEW, July, 1955, Newsstand Edition. Vol. LVII, No. 9. Published monthly from November to July inclusive at Emmett Street, Bristol, Conn. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription $4.00; Canadian and Foreign subscription, $4.50. Entered as second-class matter December 23, 1949, at the Post Office at Bristol, Conn., under the Act of March 3, 1879.

To the engineer with a bent for research...



TEST OF TIME *passed by small gas turbines at AiResearch, with proved performance in the field. AiResearch has developed and produced more small gas turbines than any other company in the world.*

AiResearch is looking for your kind of engineer.

At AiResearch, we operate on the very frontier of present scientific knowledge. Through the years, we have made a practice of anticipating the trend of modern engineering and being ready with the answers.

A typical example of progress is our activity in the rapidly expanding field of small turbomachinery. AiResearch pioneered small turbines and now has more experience in their design, development and manufacture than all other companies combined. We have also led the way in the development of aircraft pressurization and airconditioning and of pneumatic, electronic, and heat transfer systems. All of America's modern aircraft contain AiResearch equipment. We lead and intend to increase that leadership.

That's why we need creative engineers . . . and appreciate them. You who qualify for an AiResearch position will receive stimulating assignments, utilize some of the finest research facilities in the country and be well rewarded financially.

Premium positions are now open for mechanical engineers . . . electrical engineers . . . physicists . . . specialists in engineering mechanics . . . specialists in aerodynamics . . . electronics engineers . . . aeronautical engineers.

Write to Mr. Wayne Clifford, AiResearch Manufacturing Company, 9851 S. Sepulveda Blvd., Los Angeles 45, California. Indicate your preference as to location between Los Angeles and Phoenix.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

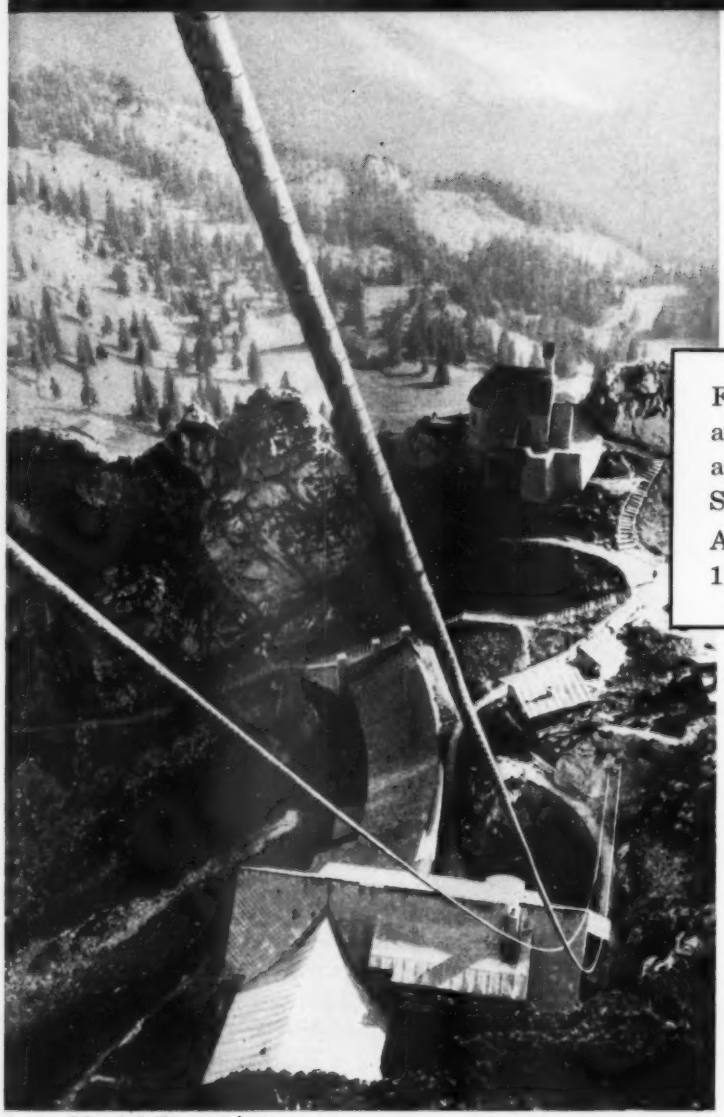
Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

Styroflex Coaxial Cable

FIRST CHOICE FOR

DIFFICULT MOUNTAINOUS CONDITIONS!



Courtesy Felton & Guilleaume, Cologne

After 5 Years of Rigorous Service in the Swiss Alps, the Electrical Characteristics of Styroflex are Unchanged!

FM Installation of Styroflex Cable armored for 25-ton ice load at the Wendelstein Alp near the Swiss border.
Aluminum sheath approximately 1⅛ inches OD.

Ideal for Remoting Video Circuits for both Television and Radar!

Inquiries regarding your particular problems will be welcomed by our engineering staff.

PHELPS DODGE COPPER PRODUCTS CORPORATION
40 WALL STREET, NEW YORK 5, N.Y.

5 ROSS Plants
12 ROSS Offices... *throughout U.S. and Canada*

Most Extensive And Best Equipped Organization In The World For Designing And Manufacturing Air Processing Systems For Industry

An industrial air system bearing the name ROSS has considerably more behind it than just a salesman and a shop. Each piece of ROSS equipment represents the result of more than 30 years of experience, the combined engineering skill of the largest staff of specialists in this field, the most exhaustive research and testing and the finest plant manufacturing facilities and equipment.

Systems For
DRYING
BAKING
CURING
HEATING
COOLING
CONDITIONING
HIGH PRESSURE HOT WATER HEATING
and similar systems

ROSS offers a complete engineering team consisting of sales engineers, control engineers, electrical engineers, material handling specialists, experts on fans, etc. with a thorough knowledge of the engineering principles involved to produce the desired results.

J. O. ROSS ENGINEERING CORPORATION

Saxton W. Fletcher '18 — President

Main Office: 444 MADISON AVENUE, NEW YORK 22, N. Y.

ATLANTA • BOSTON • CHICAGO • DETROIT • SEATTLE • LOS ANGELES

ROSS ENGINEERING OF CANADA, LIMITED, MONTREAL, CANADA • CARRIER-ROSS ENGINEERING COMPANY LIMITED, LONDON, ENGLAND

da

N. J.

g

r-
gi-
al
e-
th
n-
to

ON

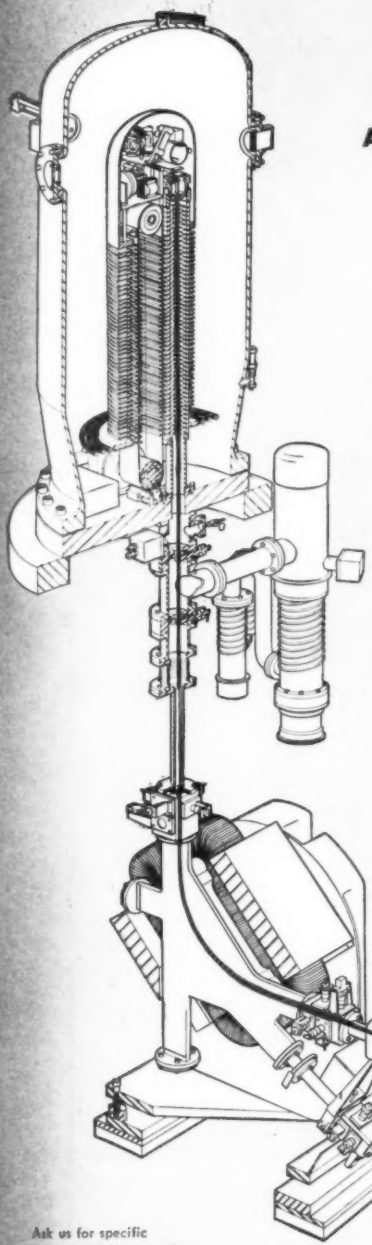
ANGELES

, ENGLAN

REVIEW

the *Van de Graaff*®

. . . ideal radiation source



for
FUNDAMENTAL
and
APPLIED RESEARCH
meets these
stringent
requirements

It produces a beam of any fundamental particle or radiation—electrons, x-rays, protons, deuterons, tritons, neutrons.

Its beam is intense, homogeneous, of known energy, and of predictable direction and dimensions.

Its beam characteristics are stable and controllable over a wide range of energies.

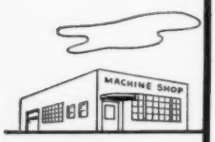
. . . now used in these applications

- *Nuclear cross-section measurements*
- *Cancer therapy*
- *Radiobiological research*
- *Radiation chemistry*
- *Chemical analysis of surface films*
- *Neutron activation analysis*
- *Radioactive isotope production*
- *Industrial radiography*
- *Sterilization of foods and drugs*
- *Instrument calibration*
- *Radiation standards*
- *Injectors for giant accelerators*
- *Metallurgical research*
- *Radiation damage*
- *Geophysical research*
- *Fundamental problems in physics and chemistry*

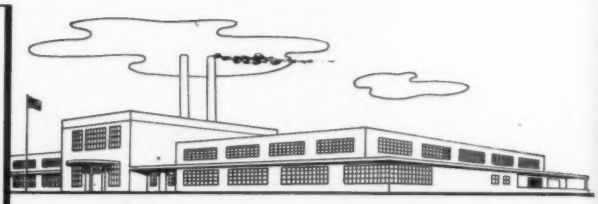
Ask us for specific recommendations on the application of Van de Graaff particle accelerators in your radiation engineering program.

HIGH VOLTAGE ENGINEERING CORPORATION

7 UNIVERSITY ROAD CAMBRIDGE 38, MASSACHUSETTS



In all forms of Industry, from small repair shops to large production plants . . .

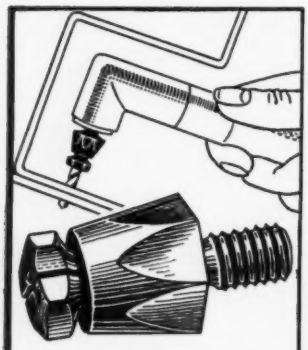


"Awkward-Spot"

DRILLING and TAPPING problems are easily solved with these popular . . .

RITMAR TOOLS

Users of RITMAR Tools include most of the civil and military aircraft builders — and virtually all the major airlines — in the U. S. and Canada, as well as the best-known manufacturers of motors, appliances, instruments, machinery, etc.



RITMAR MIDGET CHUCKS

for use with angle drills and flexible shafts. Hold broken drills.

Perhaps this group of devices contains the solution to one or more of **YOUR** manufacturing, reworking, or repairing problems.

The "LITTLE BEAVER" DRILL EXTENSION

for "Remote-Spot" drilling operations. Interchangeable chucks hold drills in sizes from #52 to #10.

NO GEARS—
NO BEARINGS—
NO MAINTENANCE REQUIRED.

The RITMAR "Flex-Drill"

The inexpensive hand tool for "Awkward — Spot" drilling jobs.

Both **MACHINE** and **HAND TAPPING**

The RITMAR TAP EXTENSION

for "Remote-Spot" tapping.

Holds regular taps. Has positive drive. Taps can be replaced without the use of tools.

For descriptive literature on any or all of the above items, write to —

RITMAR *Corporation*

183 NEW YORK AVENUE
HUNTINGTON, L. I., NEW YORK

W. A. CRESSWELL, JR. President II–'36

GRAVER Fabricates All-Welded Revolving Frames for P&H Power Shovels

The versatile P&H Dragline pictured above, feeding rock onto a conveyor (Model 1055 LC) uses an all-welded revolving frame for extra strength. Graver recently fabricated five such assemblies for the Harnischfeger Corporation, one of which is shown in the inset.

This is an integrally welded rigid unit of box section design to withstand the great variety of stresses it will encounter. Traditional Graver quality is seen in the uniform welds which were inspected during manufacture by the most modern and comprehensive techniques. These include the initial accurate dimensional inspection on specially designed layout tables, periodic visual inspections, and magnetic particle and X-ray inspections.

Graver has achieved a reputation for developing new equipment and advanced techniques and is expert in welding carbon and stainless steels, and aluminum. For the more complex, difficult welding problems consult your Graver engineering representative. Meanwhile write for new illustrated brochure, "WELDMENTS."

GRAVER TANK & MFG. CO., INC.

East Chicago, Indiana

CHICAGO • NEW YORK • PHILADELPHIA • EDGE MOOR, DEL. • CATASAUQUA, PA. • PITTSBURGH • CLEVELAND • DETROIT • TULSA • SAND SPRINGS, OKLA. • HOUSTON • ODESSA, TEXAS • CASPER, WYO. • LOS ANGELES FONTANA, CAL. • SAN FRANCISCO

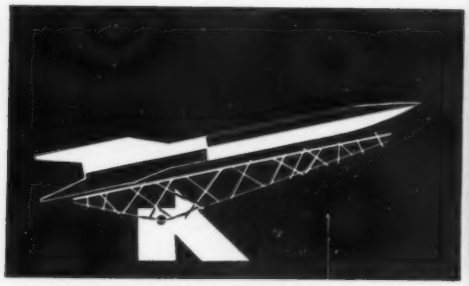
GRAVER ... *source for quality weldments*

ENGINEERING OPPORTUNITY

Investigate the

NORTH AMERICAN AVIATION'S *many diverse*

AIR FORCE SM-64 NAVAHO



GUIDED MISSILES

Aerodynamics · Thermodynamics · Missile Airframe Structures · Armament Systems and Components · Weapons Systems Engineering · Flight Test Operations and Instrumentation · Power Plant Systems

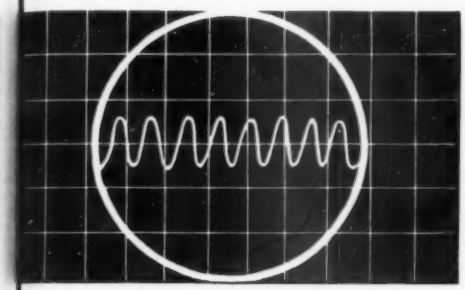
At North American you can join an engineering team . . . staffed by key engineering personnel . . . and help push back the frontiers of airframe, automatic guidance and control systems for missiles, fire and flight control systems for jet aircraft, and rocket engine research and development. You'll find that North American is aware of your worth. Your time, talent and training will be amply rewarded and given full opportunity to grow with North American's progress.

If your background equips you for a career in aerodynamics, thermodynamics, electro-mechanical engineering and manufacturing, North American offers you unlimited opportunity. The engineering, pioneering and know-how that established the company that has built more airplanes than any other is contributing to leadership in these new and expanding fields.

Y UNLIMITED !

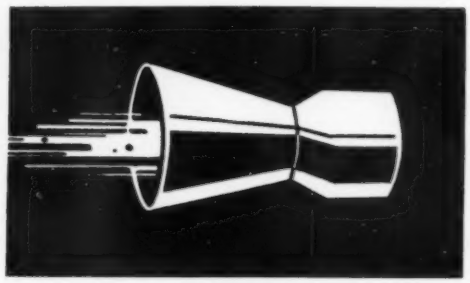
Hundreds of career openings in major projects . . . Including the

Intercontinental Guided Missile Project.



ELECTRO-MECHANICAL ENGINEERING

Analog and Digital Computers · Airborne Radar · Precision Mechanical Devices · Servomechanisms · Transistor Circuitry · Missile Autopilots · Automatic Controls · High Power Magnetic Circuitry · Timing and Pulse Circuitry · Microwave Techniques · Guidance Systems Analysis · Fire and Flight Control Systems · Auto-Navigator Systems



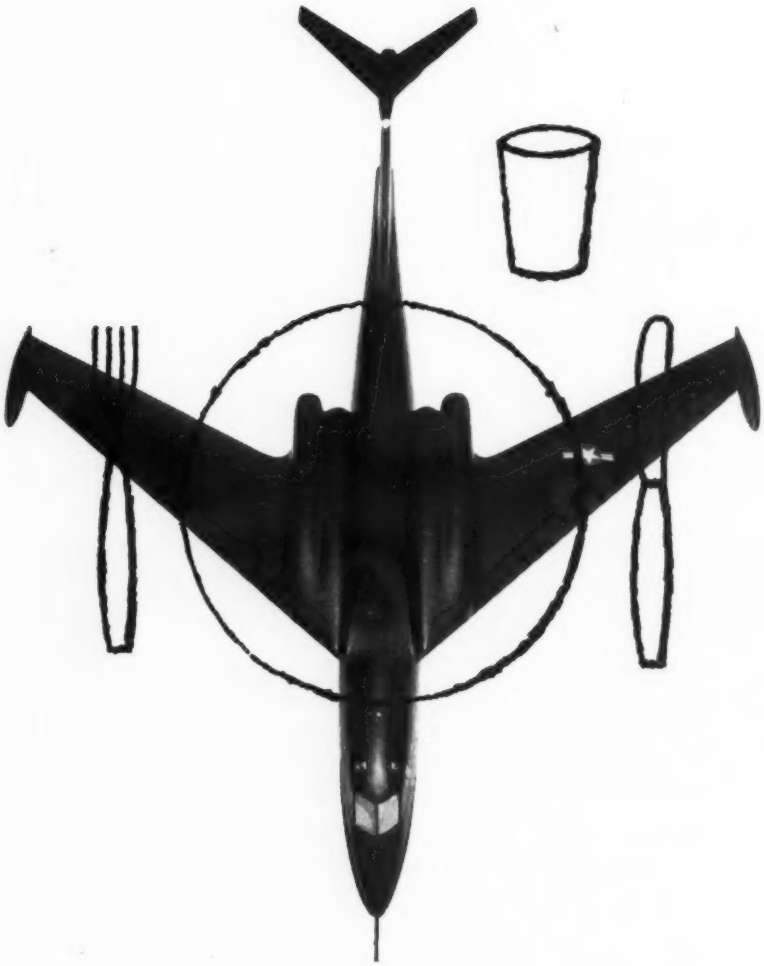
PROPULSION

Propulsion System Analysis · Rocket Engine Development and Test

Liberal Relocation Allowance, Education Refund Plan and Other Benefits

WRITE TODAY! LEARN HOW YOU CAN ASSURE YOUR FUTURE AT NORTH AMERICAN AVIATION

Write: W. S. Gudmundson, Engineering Personnel
NORTH AMERICAN AVIATION, INC.
Missile and Control Equipment Departments
12214 Lakewood Boulevard, Downey
Los Angeles County, Calif.



food for thought

Do you know that the Navy's new Martin four-jet P6M Seamaster is one of the most talked-about developments in the aircraft industry today? Do you know why it may change our whole basic concept of military operations?

And are you aware of the *other* big things that have been happening at Martin in recent months ...and that are happening today?

Do you know what possibilities—futures—careers—these developments have created for engineers who value opportunity more highly than the status quo?

If not, you'd do well to write to J. M. Hollyday, Dept. T-7, The Glenn L. Martin Company, Baltimore 3, Maryland.

...and he will tell you the Martin story. No matter how limited or how extensive your background, you will find it food for thought.

MARTIN

BALTIMORE · MARYLAND

BOSTON Gear

introduced the idea of
highest quality, interchangeable

STANDARDIZED STOCK GEARS

available promptly to
any buyer, anywhere

FROM LOCAL STOCKS

Today, Standardized BOSTON Gear
Transmission Products are the

FIRST CHOICE

for lasting economy, advanced design,
and time-saving convenience

OF 250,000 COST-WISE BUYERS

Design around BOSTON Gear
— it pays. Boston Gear Works,
Quincy 71, Mass.

H. B. BRAUDE—Class of 1913
Vice-President and General Manager

Since 1879
world's largest
manufacturer
of Standard
Stock Gears

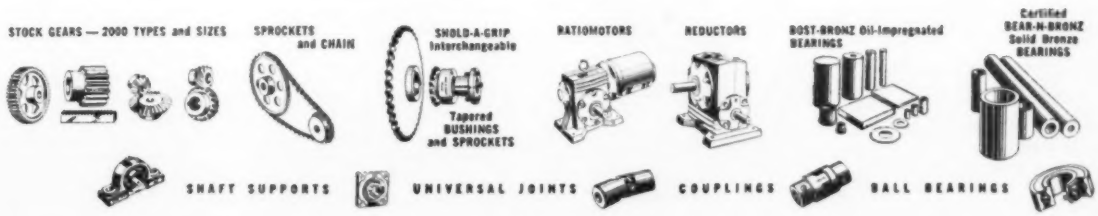
7124 STANDARD STOCK
TRANSMISSION PRODUCTS

For immediate
"off-the-shelf" delivery from

106 CONVENIENT STOCKS
AT DISTRIBUTORS
IN U. S. AND CANADA

BOSTON Gear®

Look under "Gears" in the Yellow Classified Section of your Telephone Directory for the BOSTON Gear Distributor nearest you.



custom-built equipment for the mechanical and process industries

We develop special equipment and machines from ideas to blueprints — to prototypes — to pilot plants — to the final product or process. Our technical staff and plant facilities are geared to handle the most intricate jobs all the way from small scale laboratory equipment up to contracts in excess of $1,000,000.

Phone WAltham 5-6800 or write to:

Artisan METAL PRODUCTS, INC.

73 POND STREET, WALTHAM 54, MASS.

For a comprehensive summary of our work and the equipment we make, write for our brochure "Process Equipment".

Designers and manufacturers of

AUTOCLAVES · CONDENSERS AND HEAT EXCHANGERS · DISTILLATION EQUIPMENT · EXPERIMENTAL EQUIPMENT · EVAPORATORS · JACKETED KETTLES · MIXERS · PIPE, PIPE COILS, AND BENDS · REACTORS · SPECIAL MACHINERY · TANKS

Standard Quality sets Quality Standards

The day-in, day-out excellence, the quality which is standard in every Curtis Universal Joint, has made the Curtis Joint the quality standard of the industry.

Each Curtis Universal Joint component is made from specially selected steel, individually heat-treated for a specific purpose. This accounts for the inherent balance, long life and dependable performance of Curtis Universal Joints.

CURTIS UNIVERSAL JOINTS

- 14 sizes always in stock
- Fewer parts, simpler construction
- Complete equipment for government tests

Our catalog torque and load ratings are substantiated by constant tests. You can depend on them.

Not sold through distributors. Write direct for free engineering data and price list.

Trade Mark **CURTIS**

UNIVERSAL JOINT CO., INC.

8 BIRNIE AVE., SPRINGFIELD, MASS.

As near to you as your telephone

THE TABULAR VIEW

An unusual array of brilliant talent appears in this issue of The Review as a result of addresses given in connection with Commencement or Alumni Day Events.

Shields Warren, — whose article on "Impact of Atomic Energy on the Life Sciences" appears on page 471, is Professor of Pathology, New England Deaconess Hospital. Dr. Warren was director of the Division of Biology and Medicine of the Atomic Energy Commission from 1947 to 1952 and is currently a member of the A.E.C. Advisory Committee on Biology and Medicine. He is consulting pathologist for several hospitals, and chairman, member, or consultant of dozens of medical, academic, and government committees in the fields of cancer, radiation pathology, and radiobiology.

T. Keith Glennan, — President of Case Institute of Technology, is author of "Impact of Atomic Energy on Our Economy and Way of Life" (page 473). Dr. Glennan is a businessman, scientist, and educator. During World War II he was director of the U.S. Navy Underwater Sound Laboratory, operated by Columbia University in New London, Conn. From 1950-1952 he served as a member of the Atomic Energy Commission and, after several years of public service, in 1953 he resumed the presidency of the Case Institute of Technology, in Cleveland.

James R. Killian, Jr., '26 — President of M.I.T., reports on the state of M.I.T. in his annual address "The Technology of Peace" (page 476). His farewell address to the graduates, "A Benison from Friends," appears on page 484. Dr. Killian has recently completed important work on secret national defense as chairman of a committee appointed by President Eisenhower.

Frederick May Eliot, — President of the American Unitarian Association since 1937, delivered the address, "Freedom is a Noble Thing," (page 479) at the Baccalaureate. Educated at Harvard University, Dr. Eliot also has degrees from Carleton College, Meadville Theological Seminary, the University of Minnesota, and Mount Holyoke College. He was ordained Unitarian minister in 1915, was associate minister of the First Parish Church, Cambridge, 1915-17, and minister of Unity Church, St. Paul, 1917-38.

Sir Roger Makins, — British Ambassador to the United States since 1952 gave the commencement address, "The March of Mind," which appears on page 480. Sir Roger was educated at Winchester and Christ Church, Oxford, was elected Fellow of All Souls College, Oxford, and was admitted to the bar in 1927. In 1928 he decided to enter foreign service and from 1934 to 1942 was in the Foreign Office in London. During World War II he served in West Africa and at the Allied Headquarters Mediterranean Command.

Princess Ileana of Romania, — whose article "Looking Toward Tomorrow," appears on page 482, is an accomplished lecturer, author of two books dealing with Romania in the war years, and author of many magazine articles. Trained in social work by her mother, Queen Marie, Princess Ileana founded the Girl Scout movement in Romania and aided in the building and operation of a hospital in Romania before and after the Russian occupation.

Arthur S. Flemming, — on leave as President of Ohio Wesleyan University, now serves as Director of the Office of Defense Mobilization. His thoughts on "Is War Inevitable?" are recorded on page 483. Dr. Flemming has been chairman of the Advisory Committee on Personnel Management for the Atomic Energy Commission, chairman of the Management-Labor Policy of the War Manpower Commission, and recently member of the President's Advisory Committee on Government Organization, a member of the Defense Department Organization Committee, and a member of the United States Civil Service Commission.

It Took Only About 10 Minutes to Pull a Simplex-Anhydrex 5KV Cable Through Six Floors of Conduit

When transformers became too heavily overloaded in a Boston office building recently, it became necessary to install a circuit breaker, a unit substation, and a 5kv cable.

The cable, Simplex Anhydrex XX-insulated, shielded, and neoprene-jacketed, was pulled in from the seventh floor unit substation to the circuit breaker on the ground floor.

Negotiating four right-angle turns and approximately 230 feet of steel and fiber conduit, the cable reached the circuit breaker room in about ten minutes.

The cable came through the conduit so fast, the crew at the lower end were hard-pressed to keep the pulling rope from jamming.

Simplex Lubricant No. 3 helped make this fast pulling job possible.

Simplex Rubber Insulations

ANHYDREX XX for power cables (3kv to 25kv and over) — resists heat, oxidation and ozone — has low water absorption.

ANHYDREX for power cables (0 to 2kv), and control, communication and signal cables — resists heat and oxidation — has low water absorption.

Write the address below for more details about ANHYDREX.

Simplex

SIMPLEX WIRE & CABLE CO.

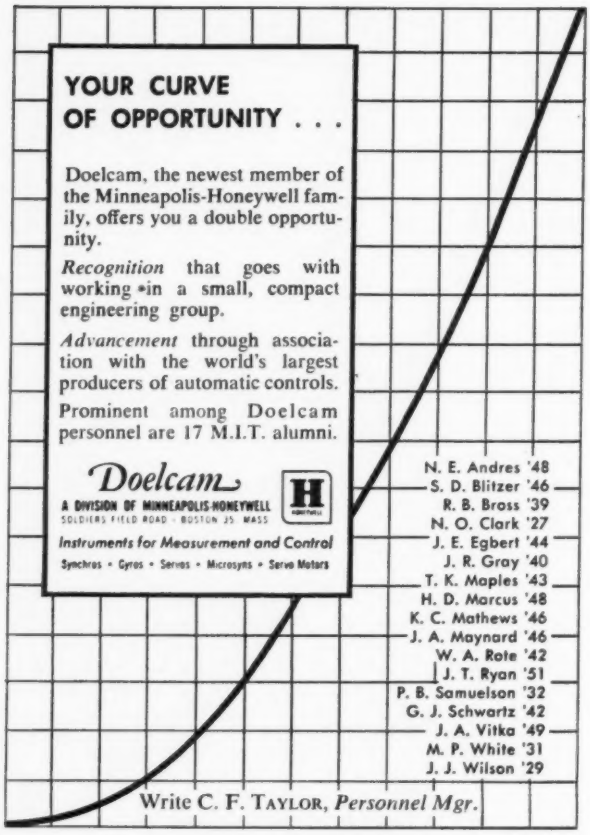
79 SIDNEY STREET, CAMBRIDGE 39, MASSACHUSETTS

7
6
5
4
3
2
1

Top Photo: Pothead of 500 kva dry-type transformer on seventh floor. Secondary feeds 110/220 volts to four floors above.

Middle Photo: Wire mesh grip on sixth floor holds weight of cable. Feeder runs through four-inch steel conduit from first to seventh floors.

Bottom Photo: Feeder connection at air circuit breaker on first floor. Cable transmits 4160 volts.


YOUR CURVE
OF OPPORTUNITY . . .
Doelcam, the newest member of the Minneapolis-Honeywell family, offers you a double opportunity.
Recognition that goes with working in a small, compact engineering group.
Advancement through association with the world's largest producers of automatic controls.
Prominent among Doelcam personnel are 17 M.I.T. alumni.
Doelcam
A DIVISION OF MINNEAPOLIS-HONEYWELL
SOLDIERS FIELD ROAD · BOSTON 35, MASS
Instruments for Measurement and Control
Synchros • Gyros • Servos • Microsyns • Servo Motors
N. E. Andres '48
S. D. Blitzer '46
R. B. Bross '39
N. O. Clark '27
J. E. Egbert '44
J. R. Gray '40
T. K. Maples '43
H. D. Marcus '48
K. C. Mathews '46
J. A. Maynard '46
W. A. Rote '42
J. T. Ryan '51
P. B. Samuelson '32
G. J. Schwartz '42
J. A. Vitka '49
M. P. White '31
J. J. Wilson '29
Write C. F. TAYLOR, Personnel Mgr.

Get in touch with
RAYTHEON
for product, performance or application information on . . .
SEMI-CONDUCTOR
TRANSISTORS AND DIODES
TUBES
MINIATURE*
NUCLEONIC
RECTIFIER
RUGGED
SUBMINIATURE*
TRANSMITTING
VOLTAGE REFERENCE*
VOLTAGE REGULATOR*
* Many types available to military specifications for Reliable Tubes
RAYTHEON
Excellence in Electronics
RAYTHEON MANUFACTURING COMPANY
Receiving Tube Division — Home Office:
55 Chapel St., Newton 58, Mass. Bigelow 4-7500
For Application Information Write Or Call The Home Office Or
9501 Grand Avenue, Franklin Park (Chicago), Ill., TUxedo 9-5400
589 Fifth Avenue, New York 17, New York, Plaza 9-3900
622 South La Brea Ave., Los Angeles 36, California, WEbster 8-2851

MAIL RETURNS

Credit Where Due

From Ward Allen Howe:

Raymond E. Hansen is a good photographer but the cover picture of the May issue credited to him happens to be one that I took. I am sure that neither he nor the editor will object to this correction.
New York, N. Y.

The view of the Jefferson Memorial and apple blossoms in Washington, D.C., as used on The Review's cover in May does indeed represent the work of Mr. Howe who has our apologies for incorrect credit line.—Ed.

Moral Energies

From Arthur L. Willitson:

I read with great interest your article on the "Limitations of Logic in Engineering Education" which appears in the March number of The Technology Review.

To me it is very fascinating to have the Head of one of the very important departments at Massachusetts Institute of Technology venture to publicly criticize the educational procedures of the Institute and suggest radical changes for the improvement thereof.

I like especially your inclusion within the range of disciplined and developed human attributes *emotional, moral, physical,* and *mental* qualities, and I only regret that you did not add to these four important features the one which I regard as certainly of primary importance: i.e., moral energies.

(*Concluded on page 512*)

The Review is not published during the summer months following July. This issue, therefore, concludes Volume 57. Number 1 of Volume 58 will be published on October 27 and dated November. Readers who bind their copies are reminded that if they possess nine issues of Volume 57, their files are complete. An index to the volume will be ready on September 15 and will be supplied post free upon request.

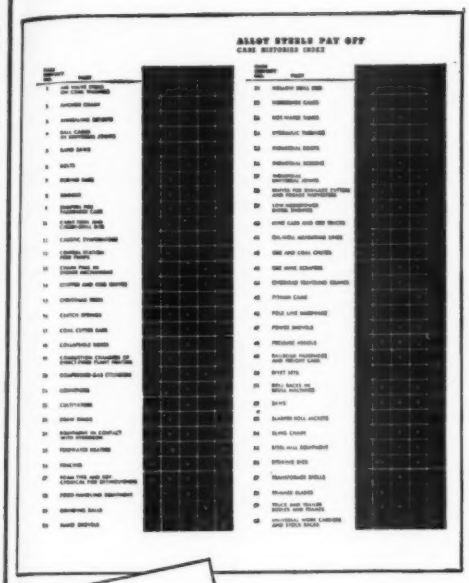
Canada Dry Ginger Ale, Inc., Philadelphia (5 contracts)

38th YEAR as Industrial Builders

We have specialized in industrial construction for the past 38 years, having had 777 contracts from many of the country's outstanding firms.

Over this period of years, approximately 80% of our business has come from clients for whom we have built before—convincing proof of satisfactory service.

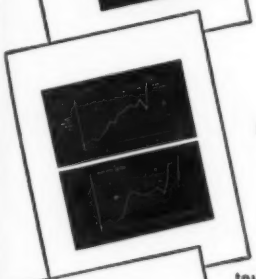
W. J. BARNEY CORPORATION
Founded 1917
101 Park Avenue, New York
Alfred T. Glassett, '20, President



60 fully documented case histories

Facts on maximum pay load

Facts on lower operating costs



Facts on lower corrosion rate

Facts on toughness, wear, strength

CLIMAX MOLYBDENUM COMPANY, Dept. U
500 Fifth Avenue, New York 36, N. Y.

Please send me the 208-page handbook
"Alloy Steels Pay Off"

Name_____

University_____

School_____

Address_____

MAIL THIS TODAY

If you're working for an engineering degree, here's the handbook you should have

This fact-packed handbook is a must if you are studying engineering. Here, with complete engineering data, you'll find how the use of alloy steels adds economies, increases service life, offers many other advantages.* It contains a valuable section on costs that you will find most important because it spells out the economies of alloy steel. Design and metallurgical engineers now in industry have found the 60 case histories showing the advantages of alloy steels interesting and instructive. You will find this entire book to be an excellent reference for thesis projects and a valuable tool after you graduate. Send for your free copy. Climax Molybdenum Company, 500 Fifth Avenue, New York 36, New York.

MUS-19

***Advantages of ALLOY STEELS**

- longer life
- greater pay load
- lower operating costs
- greater safety
- less maintenance

CLIMAX MOLYBDENUM

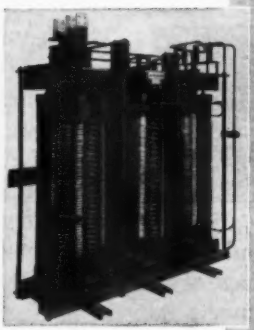
HEVI DUTY

Precision Electric
HEAT TREATING
FURNACES

Industrial

Laboratory

Dry Type
Air-Cooled
TRANSFORMERS
2 VA to
2000 KVA



Static Type
CONSTANT
CURRENT
REGULATORS

HEVI DUTY ELECTRIC COMPANY

MILWAUKEE 1, WISCONSIN
Harold E. Koch, '22, *President*
Elton E. Staples, '26, *Exec. Vice President*
Chester Meyer, '36, *Works Manager*

INDEX TO ADVERTISERS

July, 1955

Advertiser	*Page*
A	
AMF Atomics, Inc.	498, 499
Aircraft-Marine Products, Inc.	458
AiResearch Manufacturing Company	438
Albert Pipe Supply Company, Inc.	532
Allegheny Ludlum Steel Corporation	514
Alumni Association	518, 519
American Machine and Foundry Company	498, 499
American Steel and Wire	505
Amsan	532
Artisan Metal Products, Inc.	448
Atlantic Chemical Corporation	521
Atlantic Gelatin	523
Atomic Instrument Company	459
Automatic Switch Company	510
B	
Banister Company, A. W.	529
Barney Corporation, W. J.	450
Beetle Boat Company, Inc.	522
Blanchard Construction Company	533
Bludworth Marine	532
Boston Gear Works	447
Boston Manufacturers Mutual Fire Insurance Company	503
Brewer, Given	535
C	
Cabot, Inc., Godfrey L.	453
Caldwell-Scott	523
Capitol Engineering Corporation	535
Chauncy Hall School	534
Cleverdon, Varney and Pike	535
Climax Molybdenum Company	451
Coburn and Company, William H.	508
Combustion Engineering, Inc.	501
Converse Rubber Company	517
Coop, The (Harvard Square Store)	516
Corrigan Company, Inc., J. C.	522
Curtis Universal Joint Company, Inc.	448
D	
DeBell and Richardson, Inc.	511
Debes and Associates, Charles Nelson	535
Deecy Products Company	530
de Florez Company, Inc., The	525
Dexter Chemical Corporation	526
Diefendorf Gear Corporation	456
Doelcam	450
Doelger, Inc., Peter	533
Douglas Aircraft Company, Inc.	525
Drake and Townsend, Inc.	529
Draper Corporation	536
Durotex Corporation	527
Dwight Building Company, The	523
E	
Eadie, Freund and Campbell	535
Eastern Engineering Company	519
Eisenberg, Inc., Eugene R.	533
Electronics Corporation of America	509
Empresas Ferre	527
F	
Fabric Research Laboratories, Inc.	535
Fairfield and Ellis	513
Fay, Spofford and Thorndike	535
Ferre Export Corporation	527
Fletcher Company, H. E.	506
Flush-Metal Partition Corporation	Inside Back Cover

(*Continued on page* 454)

RS

Page

8, 499
.. 458
.. 438
.. 532
.. 514
8, 519
8, 499
.. 505
.. 532
. 448
. 521
. 523
. 459
. 510

. 529
. 450
. 522
. 533
. 532
. 447
. 503
. 535

. 453
. 523
. 535
. 534
. 535
. 451
. 508
. 501
. 517
. 516
. 522
. 448

511
535
530
525
526
456
450
533
525
529
536
527
523

535
519
533
509
527

535
513
535
527
506
over

IEW

Looking for a SALES ADVANTAGE ?

Cabot, famous for carbon blacks, introduces some exciting new white pigments and other products . . . products that you should be investigating if your goal is constant improvement of your own manufactured goods. Some of these new Cabot materials are already providing advantages for other manufacturers, so why not find out for yourself about some of these new product facts? You can't afford to miss a sales opportunity . . . a sales opportunity that Cabot may have for the asking . . . write or call —

( ) **NEW** *thermal carbon blacks for mechanical and extruded rubber goods . . . natural rubber tubes. As the world's only manufacturer of a complete range of channel, furnace and thermal blacks, Cabot offers more than 45 different grades for use in rubber, ink, paint, varnish, lacquer, plastics and paper products.*

( ) **NEW,** *white uniform calcium silicate—Wollastonite. As an inert paint extender, it has more desirable properties than other extenders singly or combined. Excellent for dry pressing of wall tile and semi-vitreous ceramic products and as a mineral filler for polyester resins.*

( ) **NEW,** *almost chemically pure silica—Cab-o-sil. An "airborne" silica for increasing the viscosity of polyester resins to a desired working consistency. Also used for rubber, plastics, paints, varnish, printing inks, pharmaceuticals, cosmetics, insecticides, adhesives, floor waxes.*

( ) **NEW,** *almost chemically pure, extremely fine alumina pigment—Alon C. For textiles, rubber, plastics, paints, varnish, printing inks, pharmaceuticals, cosmetics, insecticides, adhesives, floor waxes.*

( ) **NEW** *plasticizers offering improved flexibility permanence—Cabflex ODP and Cabflex ODA and others. Two of a complete range of plasticizers developed for the specific improvement of vinyl plastics products.*

( ) **NEW** *Elftex carbon blacks. Fluffy oil furnace blacks specifically developed to give letterpress inks same quality printed blackness previously obtained only with higher priced channel blacks.*

(✓) *For complete information, check the Cabot products that interest you . . . write*

CABOT **Godfrey L. Cabot, Inc.** 77 FRANKLIN STREET, BOSTON 10, MASSACHUSETTS

Branch Offices or Agents in all Principal Cities of the World

INDEX TO ADVERTISERS

(*Continued from page* 452)

Advertiser	*Page*
G	
Gannett Fleming Corddry and Carpenter, Inc.	529
Garrett Corporation, The	438
General Radio Company	Outside Back Cover
Gilbert Associates, Inc.	535
Goodyear Tire and Rubber Company, The	464
Graver Tank and Manufacturing Company, Inc.	443
H	
Hart Products Corporation, The	528
Haskell-Dawes Machine Company, Inc.	510
Hevi Duty Electric Company	452
Higgins Ink Company, Inc.	520
High Voltage Engineering Corporation	441
Hinde and Dauch	527
Holmes and Narver, Inc.	534
Hotel Commander	516
Hycon Eastern, Inc.	504
Hycon Manufacturing Company	515
I	
Industrial Oil and Chemical Company	529
J	
Jackson and Moreland	535
K	
Kaighin and Hughes, Inc.	511
Kerite Company, The	525
Kohler Company	454
Kuljian Corporation, The	535
L	
Leonard Construction Company	534
Lessells and Associates, Inc.	535
Lougee and Company, N. A.	534
Lummus Company, The	Inside Front Cover
M	
Main, Inc., Chas. T.	523
Manufacturers Mutual Fire Insurance Company	507
Martin Company, The Glenn L.	446
Mason Company, L. E.	524
M.I.T. Instrumentation Laboratory	504
Melpar, Inc.	530
Metcalf and Eddy	535
Meyne Company, Gerhardt F.	525
Miniature Precision Bearings, Inc.	437
Moran, Proctor, Mueser and Rutledge	535
Murray Printing Company, The	528
Mutual Boiler and Machinery Insurance Company	503
N	
Naresco Equipment Corporation	462
National Research Corporation	462, 463
New London Instrument Company, Inc.	528
Nicholson Company, The	456
North American Aviation, Inc.	444, 445
Nuclear Science and Engineering Corporation	518
P	
Phelps Dodge Copper Products Corporation	439
Ponce Cement Corporation	527
Ponce Products, Inc.	527
Porto Rico Iron Works, Inc.	527
Precision Products Company Inc of Waltham	526
Puerto Rico Cement Corporation	527
Puerto Rico Clay Products Corporation	527
Puerto Rico Glass Corporation	527
Puerto Rico Pulp and Paper Corporation	527

(*Concluded on page* 456)

Three-way plug valve

Static pressure selector valve

KOHLER

PRECISION CONTROLS

used in new turbo-prop airplanes

Vickers has selected Kohler Precision Controls for the new Viscounts, first turbo-prop airplanes to fly scheduled airlanes by Capital Airlines in United States. Kohler three-way plug valves serve the fuel systems, and static pressure selector valves operate the air-speed indicators.

Kohler Co. is a leading supplier to manufacturers of commercial, military and private aircraft, and jet engines. Facilities for forging, casting, machining and anodizing are maintained in one plant. Controls are developed to specification for volume production. Write for booklet.

Kohler Co., Kohler, Wisconsin. Established 1873

KOHLER OF KOHLER

PLUMBING FIXTURES • HEATING EQUIPMENT • ELECTRIC PLANTS • AIR-COOLED ENGINES • PRECISION CONTROLS

ENGINEERS

looking for . . .

. . . a good start?

. . . rapid development of your professional skill?

you can have either at Sperry,

PIONEERS IN A WIDE RANGE OF FIELDS, FOR MORE THAN 44 YEARS

We invite you to investigate the exceptional employment opportunities available on our unusually large research, design, & development staff, in many fields including the following:

Klystron & Traveling Wave Tubes	*Radars*
Transistors & Networks	*Gyroscopics*
F. H. Motors & Transformers	*Magnetic Amplifiers*
Digital & Analogue Computors	*Microwave Systems*
Wave Guides & Antennaes	*Servo-Mechanisms*

- Advanced and challenging assignments
- Association with top Engineers—Many MIT Graduates
- Interesting, diversified work
- Remuneration based on professional abilities
- Modern plant—Latest laboratory facilities
- Adequate housing
- And of course, employee benefits, and congenial surroundings, among the finest.

Please submit resume to our Engineering Personnel Section. (Personal interviews may be arranged in your city.)

SPERRY GYROSCOPE CO.

Division of the Sperry Corp.

Great Neck, Long Island, N.Y.

SPERRY

GEARS

Made to Your Specifications

You and we can form a team—you to draw up the specifications; we to make the gears—that will be profitable to both of us. Gears of all types, all sizes, all materials. Design-engineering service available.

Custom Gears Exclusively

DIEFENDORF GEAR CORPORATION

Syracuse 1, N. Y.

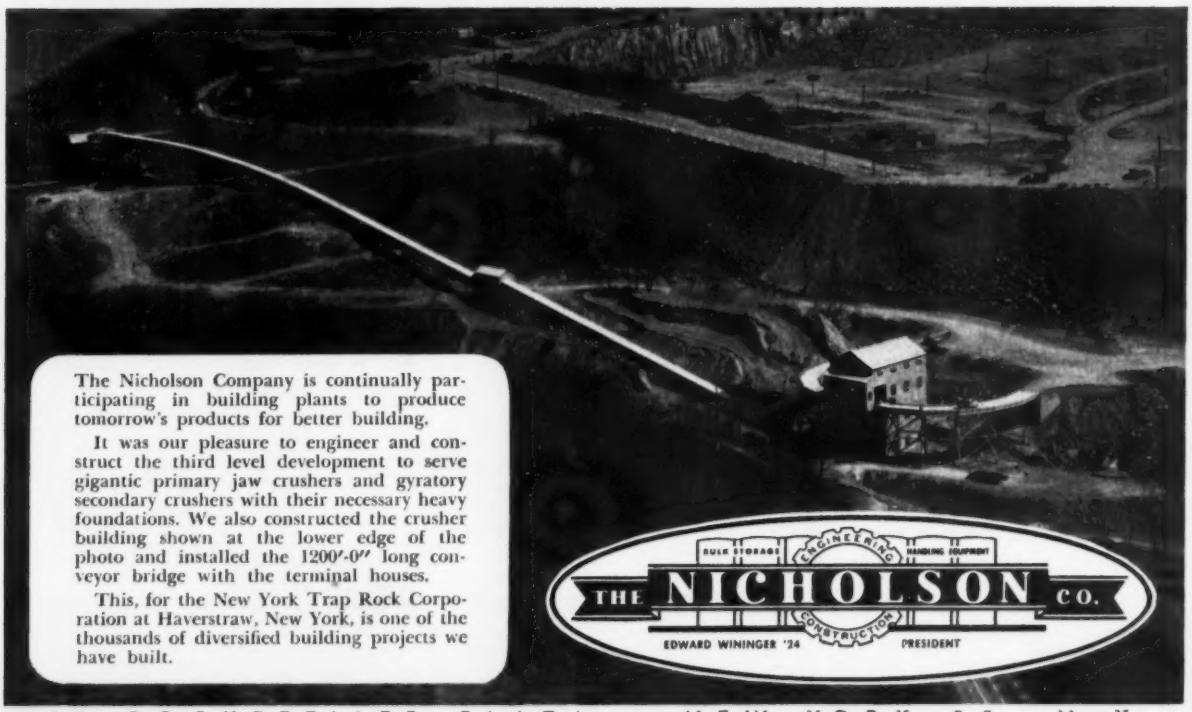
DIEFENDORF GEARS

INDEX TO ADVERTISERS

(*Concluded from page 454*)

Advertiser	*Page*
R	
Raymond Concrete Pile Company	520
Raytheon Manufacturing Company	450
Reidy, Maurice A.	535
Research-Cottrell, Inc.	460
Revere Copper and Brass, Inc.	497
Ritmar Corporation	442
Ross Engineering Corporation, J. O.	440
Roth Laboratory for Physical Research	534
S	
Scully Signal Company	514
Simplex Wire and Cable Company	449
Sperry Gyroscope Company	455
Standard Oil Company (Indiana)	512
Stevens-Arnold, Inc.	510
Syska and Hennessy, Inc.	534
T	
Taylor and Sons, Thomas	531
Technology Instrument Corporation	508
Technology Press, The	502
Tracerlab, Inc.	461
Tredennick-Billings Company, The	533
Tubed Chemicals Corporation	533
U	
United States Steel Corporation	505
W	
Webb Company, Jervis B.	526
Weston Electrical Instrument Corporation	457
Wolfe Company, A. J.	530

MATERIALS FOR THE CONSTRUCTION OF TOMORROW



The Nicholson Company is continually participating in building plants to produce tomorrow's products for better building.

It was our pleasure to engineer and construct the third level development to serve gigantic primary jaw crushers and gyratory secondary crushers with their necessary heavy foundations. We also constructed the crusher building shown at the lower edge of the photo and installed the 1200'-0" long conveyor bridge with the terminal houses.

This, for the New York Trap Rock Corporation at Haverstraw, New York, is one of the thousands of diversified building projects we have built.

BULK STORAGE · ENGINEERING · MATERIAL HANDLING EQUIPMENT

THE NICHOLSON CO.

CONSTRUCTION

EDWARD WININGER '24 PRESIDENT

10 ROCKEFELLER PLAZA · NEW YORK 20, N. Y.

Page
520
450
535
460
497
442
440
534
514
449
455
512
510
534
531
508
502
461
533
533
505
526
457
530

Why these WESTON PORTABLES excel in

STABILITY... RUGGEDNESS... SHIELDING!

Familiar in external appearance, all these portables are totally *different* inside. The movement employed is the highly stable, self-shielded WESTON CORMAG® mechanism. The *difference* is evident, in service, in several ways. The movement is far more rugged... more resistant to vibration and shock ... thus protecting instrument accuracy and dependability over far longer periods. There never need be concern about external magnetic fields, for the yoke design provides a permanent magnetic shield... so efficient that an instrument may be used at a distance of only 15 inches from a conductor carrying 1000 amperes and show an effect of less than 1/10 of 1%. And the instrument is far lighter in weight... more convenient in handling. Complete details on these Weston CORMAG® portables may be obtained from your local Weston representative, or direct from WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

WESTON
Instruments

an important symbol...

This c/a superimposed on a grid symbolizes A-MP's Creative Approach to Better Wiring. The Creative Approach is an entirely new aspect of electrical wiring based on customers own requirements and backed up by the best electrical wiring experts in the field.

Within A-MP the following are M.I.T. graduates:

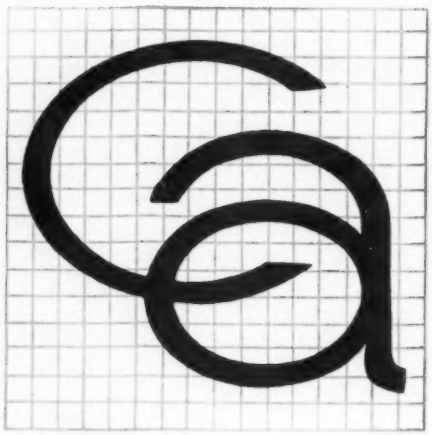
Mr. U.A. Whitaker, 1923
President

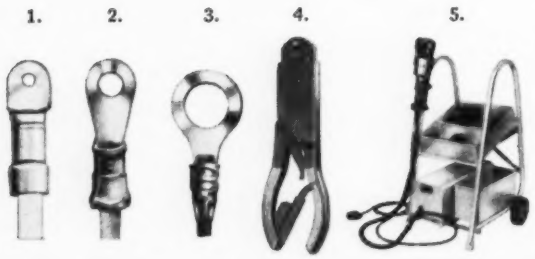
Mr. John R. Vickery, Jr., 1935
Manager Glen Rock Engineering

Mr. Franklin H. Wells, 1918
Director of Research

Mr. James H. Whitley, 1954
Research Engineer

Mr. Marshall M. Holcombe, 1936
Patent Attorney





1. A-MP TERMALUM and COPALUM Terminals for aluminum conductors in wire sizes #8 to 4/0.
2. AMPLI-BOND Terminals and Connectors are pre-insulated for wire sizes #8 to 4/0.
3. Pre-Insulated Diamond Grip Terminals and Connectors for wire sizes #26 to #10.
4. A-MP T-Head Hand Tool crimps two wire sizes, ranges; #22-16 and #16-14.
5. DYNA-CRIMP combined portability and power for crimping large size A-MP terminals and connectors.

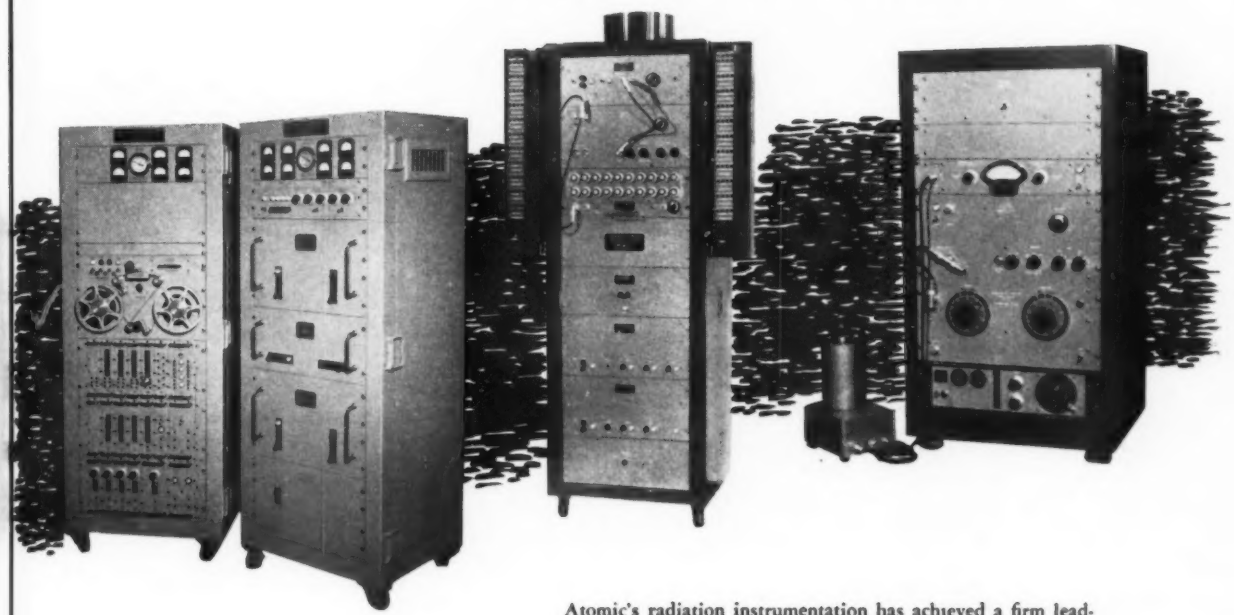
Another example of AMP's Creative Approach to Better Wiring

A-MP

©A-MP®

AIRCRAFT-MARINE PRODUCTS, INC.
2100 PAXTON STREET, HARRISBURG, PA.

SYMBOLIZING LEADERSHIP in ATOMIC ENERGY INSTRUMENTATION



Atomic's radiation instrumentation has achieved a firm leadership in nuclear and sub-atomic research laboratories conducting investigations into useful applications of atomic energy. Typical of these instruments produced over the past nine years are: Scintillation Detectors and Spectrometers, Pulse Height Analyzers and Coincidence and Anticoincidence Instruments. Other developments include High Speed Data Handling Equipment and Medical Research Apparatus.

Atomic's versatile instrumentation skills have also been applied to the development of a comprehensive line of reliable electronic instruments for Industrial Counting and Control.

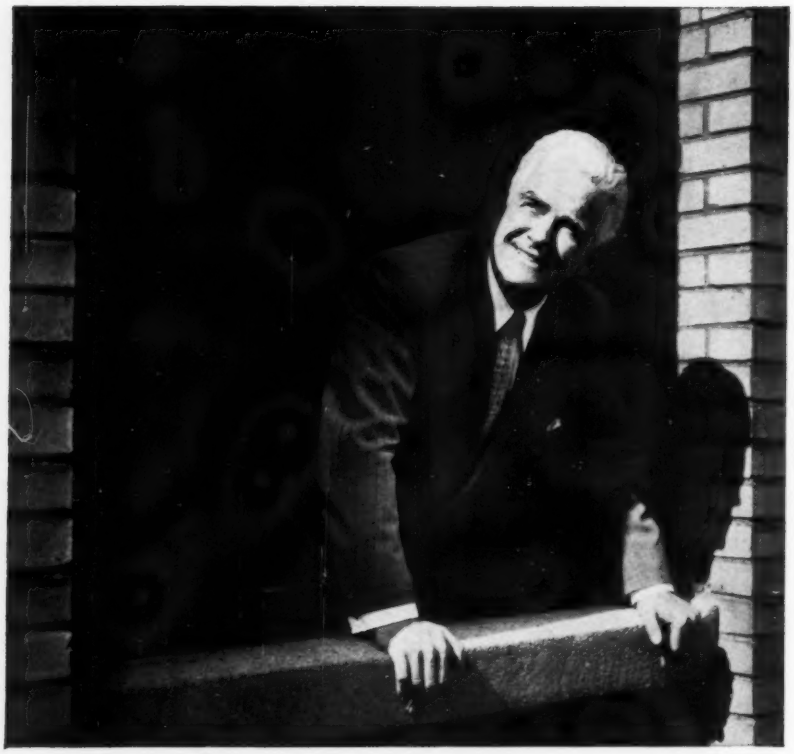
Atomic's accumulated experience in design and manufacturing provides you with the highest quality instrumentation for your scientific and industrial programs.

L. W. Cronkhite	'05
H. L. Walker	'24
S. Chao	'49
R. J. P. DeFigueredo	'50
A. L. Krasnow	'51
C. K. Campbell	'53
H. F. Staddart	'54
R. Hindel	'55
P. C. Watson	'55

ATOMIC INSTRUMENT COMPANY
CAMBRIDGE 39, MASSACHUSETTS

Representatives in principal cities— U.S. and abroad

Scintillation Detectors
High Voltage Supplies
Scalers , Linear Amplifiers
Differential Pulse Height Analyzers
Count Rate Meters, Coincidence Analyzers



Dr. Joseph W. Barker, '16,
Chairman of the Board

Bought Blue Sky ... Reaped Profit

Some industries invest in electrical precipitators for one reason only—to avoid creating smoke nuisance. Blue sky—clean stack discharge from a plant—is a good advertisement, basic in any factory community relations program.

But here is an instance where electrical precipitators pay high *cash* dividends as well. A major producer of pulp and paper uses 22 Cottrell Precipitators, installed by Research Corporation, to recover salt cake from various processes. Over 150,000 tons of this chemical are thus reclaimed each year for re-use—$3,000,000 that goes on the happy side of the ledger rather than up the stacks.

In a case like this, the collection efficiency of the equipment is of high dollar importance, just as it is in oil refineries where catalyst is recovered . . . in chemical plants where sulphuric and phosphoric acids are recovered . . . and in non-ferrous smelting plants where escape of valuable metallic dust and fume is prevented.

The higher the efficiency, the bigger the pay-off . . . or the cleaner your stacks will look, if your objective is nuisance abatement. But how do you make sure of getting highest efficiency?

First, remember that electrical precipitators are no simple, standard device. For best results, for true economy, each installation must be custom engineered. And that engineering should be based on successful past experience in meeting similar requirements and conditions.

The designer-builder with by far the largest total and broadest-ranging experience is Research Corporation. Research has designed and sold more than 2000 precipitators during the past 40 years. This experience is available to help you solve your problem, whether it's gas cleaning, nuisance abatement, recovering valuable materials, or, perhaps, some precipitator application that has never been attempted before.

Your questions will be welcomed—and please be sure to write for a copy of Bulletin GB, a quick summary of dust collection problems and facts of interest to management men.

RESEARCH-COTTRELL, INC.

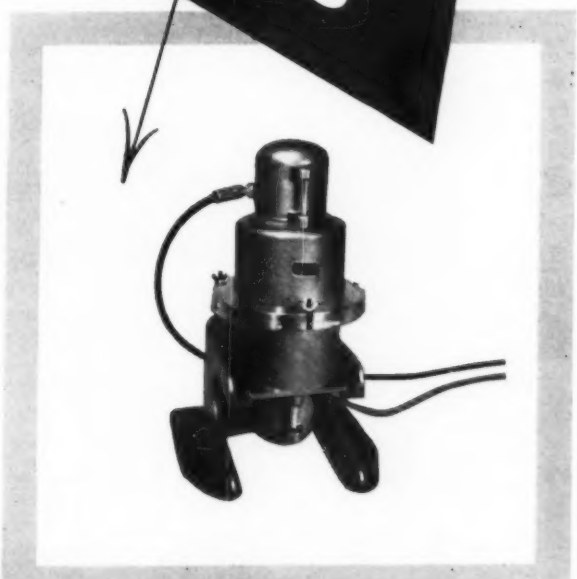
Main Office and Plant: Bound Brook, N. J.
405 Lexington Ave., New York 17, N. Y.
Grant Building, Pittsburgh 19, Pa.
228 N. La Salle St., Chicago 1, Ill.
111 Sutter St., San Francisco 4, Cal.

FROM GEIGER TUBES TO 4-PI COUNTERS

Tracerlab offers the most complete line of instruments for detection, measurement and analysis of radioactivity, as well as a full selection of accessories for the radioisotope laboratory.

Furthermore, Tracerlab has pioneered in the application of radioactivity to research and industrial problems, and leads the field in synthesis and production of compounds labeled with radioactive isotopes.

In addition to supplying instruments, equipment, radiochemicals, and training personnel, we offer consulting services equipped to handle all types of problems in the field of radioactivity. We invite your inquiry as to how we may serve you.



Tracerlab

2030 Wright Avenue, Richmond 3, Calif.
130 High Street, Boston 10, Mass.

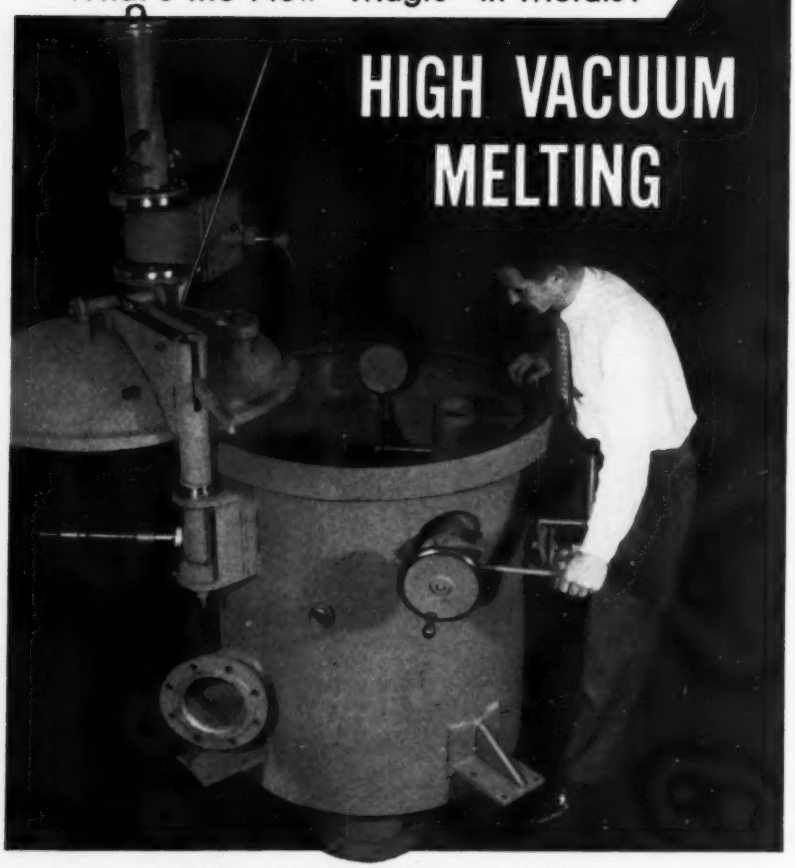
WASHINGTON · NEW YORK · HOUSTON · CHICAGO
CLEVELAND · PARIS · LOS ANGELES · PHILADELPHIA

Tracerlab KELLEKET

Excellent opportunities are available for electronic engineers and physicists seeking a career in the nuclear field.

What's the New "Magic" in Metals?

HIGH VACUUM MELTING



In NRC Vacuum Furnaces like this, conventional metals acquire new strengths and a "cleanliness" never before achieved.

NOW...

New Products are Possible

... Better, Tougher, Lower Cost

Barriers are being broken — *the barriers of conventional metal performance!* High vacuum melting is creating a new order of metals and alloys with new kinds of properties. And at National Research you will find the people with the world's greatest experience in building these high vacuum furnaces. Be sure your product designers and metallurgists are staking out your claims in this new field. Send coupon below for facts on complete line of NRC vacuum furnaces for research, development, or production — batch or semi-continuous.

NRC

NARESCO
EQUIPMENT
CORPORATION

NARESCO EQUIPMENT CORPORATION
Equipment Sales Subsidiary of National Research Corporation
147 Charlemont St., Newton Highlands 61, Mass.
Please send me NRC Vacuum Furnace Bulletin

Name_____ Title_____

Company_____

Address_____

City_____ State_____

SALES OFFICES: Boston, Chicago, Cleveland, Los Angeles, New York, Palo Alto, Philadelphia; in Canada: Toronto, Arnprior

For Presidents
who are

Thinking Five Years Ahead

An unusual, but thoroughly proved way to expand your business . . . broaden your markets . . . and improve your products through basic process research is outlined in a new brochure "Facts about the Research Division". We have been research partners in new developments ranging from frozen citrus juice — *Minute Maid Corp.* — to vacuum cast metals — *Vacuum Metals Corp.* For your copy kindly address Richard S. Morse, President, National Research Corporation.

National Research Corporation NRC

"New Enterprises through Research"

70-A MEMORIAL DRIVE, CAMBRIDGE, MASSACHUSETTS

There's only one reason for this tire

New
All-Nylon Cord
Tubeless
Double Eagle

YOU KNOW that it has to be the most advanced tire of all to be selected for this advance-styled, modern car.

And it should be selected for your car, too, if you want above all else the satisfaction of knowing you are riding on the finest tire that men can make or money can buy.

But the odds are, you won't use up all the mileage in the new All-Nylon Cord Tubeless Double Eagle. And it's not likely that you'll ever have to take full advantage of its seemingly limitless strength and protection.

Of course, it's nice to have the extra-wide margins of blowout and puncture protection from Goodyear's exclusive 3-T Nylon Cord and Grip-Seal construction, and the superior mileage and traction of its deeper, tougher Resist-a-Skid tread.

If you do happen to be the Double Eagle type, why not see your Goodyear dealer now? Goodyear, Akron 16, Ohio.

MORE PEOPLE RIDE ON GOODYEAR TIRES THAN ON ANY OTHER KIND!

GOODYEAR

The world's finest tire... by miles!

Double Eagle, T. M.—The Goodyear Tire & Rubber Company, Akron, Ohio

THE TECHNOLOGY REVIEW

TITLE REGISTERED, U. S. PATENT OFFICE

EDITED AT

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Academic Procession entering Rockwell Cage, June 10, 1955

Editor:
B. DUDLEY

Business Manager:
R. T. JOPE

Circulation Manager:
D. P. SEVERANCE

Editorial Associates:
PAUL COHEN
J. R. KILLIAN, JR.
F. W. NORDSIEK
J. J. ROWLANDS

Editorial Staff:
RUTH KING
EVANGELINE SFERES

Business Staff:
EILEEN E. KLIMOWICZ
MADELINE R. MCCORMICK

Publisher:
H. E. LOBDELL

Published monthly from November to July inclusive on the twenty-seventh of the month preceding the date of issue, at 60 cents a copy. Annual subscription, $4.00; Canadian and foreign subscription, $4.50. Published for the Alumni Association of the M.I.T.: Hugh S. Ferguson, President; H. E. Lobdell, Executive Vice-president; Richard S. Morse, Gilbert M. Roddy, Vice-presidents. Donald P. Severance, Secretary-Treasurer. Published at Hildreth Press, Inc., Bristol, Conn. Editorial Office, Room 1-281, Massachusetts Institute of Technology, Cambridge 39, Mass. Entered as second-class mail matter at the Post Office at Bristol, Conn. Copyrighted, 1955, by the Alumni Association of the Massachusetts Institute of Technology. Three weeks must be allowed to effect change of address, for which both old and new addresses should be given.

VOL. 57, NO. 9 **JULY, 1955**

CONTENTS

All photographs in this issue from M.I.T. Photographic Service

THE GREAT COURT ON ALUMNI DAY, 1955
PHOTOGRAPH BY ALBERT PAONE, M.I.T. PHOTO SERVICE .... THE COVER

PICTORIALLY SPEAKING — A PHOTOGRAPHIC MEDLEY
FRONTISPIECE 466

IMPACT OF ATOMIC ENERGY ON THE LIFE SCIENCES ..... BY SHIELDS WARREN 471

IMPACT OF ATOMIC ENERGY ON OUR ECONOMY AND WAY OF LIFE ..... BY T. KEITH GLENNAN 473

THE TECHNOLOGY OF PEACE ..... BY JAMES R. KILLIAN, JR. 476

FREEDOM IS A NOBLE THING ..... BY FREDERICK MAY ELIOT 479

THE MARCH OF MIND ..... BY SIR ROGER MAKINS 480

LOOKING TOWARD TOMORROW .... BY H.R.H. PRINCESS ILEANA 482

IS WAR INEVITABLE? ..... BY ARTHUR S. FLEMMING 483

A BENISON FROM FRIENDS ..... BY JAMES R. KILLIAN, JR. 484

"AND DEPARTING LEAVE BEHIND US —" 485

THE TABULAR VIEW · *Contributors and Contributions* 448

MAIL RETURNS · *Letters from Review Readers* 450

THE TREND OF AFFAIRS · *News of Science and Engineering* 467

THE INSTITUTE GAZETTE · *Relating to the Massachusetts Institute of Technology* 494

Pictorially Speaking

From The Review's pictorial record of events of Commencement and Alumni Day are these illustrations of interesting people and scenes. (Top row, left) General Kurt M. Landon, Admiral Edward L. Cochrane, '20, Vice-president of M.I.T., and General Einar B. Gjelsteen, who participated in R.O.T.C. Commissioning exercises. (Top row, right) Participants in the Baccalaureate were (left to right) Father J. Edward Nugent, Dr. Frederick May Eliot, who gave the Baccalaureate Address, President J. R. Killian, Jr., '26, Reverend John Crocker, Jr., and Rabbi Herman Pollack. (Left column, top) Sir Roger Makins, Commencement Speaker, and President Killian. (Left column, bottom) President Killian and Marshall Dalton, '15, discuss finances, (Right column, top) Charlotte A. Bragg, '90, and Godfrey L. Cabot, '81, are among the oldest Technology Alumni to attend the Alumni Day luncheon in the Du Pont Court. (Right column, bottom) O. B. Denison, '11, leads singing at the Alumni Banquet. (Bottom row, left) Seated at the Faculty table at the Alumni Banquet were (Left to right) Joseph E. Conrad of M.I.T. Club of New York, Horace S. Ford, Thomas T. Pitre, Fred M. Hartwell, and James E. MacDonald. (Bottom row, center) Hugh S. Ferguson, '23, President of the Alumni Association, presents certificate of Honorary Membership to John J. Rowlands, Director of M.I.T. News Service. (Bottom row, right) Dwight C. Arnold, '27, receives gavel from Hugh S. Ferguson, whom he succeeds as president of the Alumni Association.

THE
TECHNOLOGY
REVIEW

Vol. 57, No. 9 July, 1955

The Trend of Affairs

Soft Policy

DESPITE the annual crops of graduates who receive their degrees in science or engineering – estimated to be about 20,000 this year – educators and personnel consultants remain deeply concerned about the nation's continuing shortage of engineers. Newspapers and technical journals print page after page of advertising in which firms offer high wages, good pension plans, suburban working conditions and other inducements to young men – and women – to follow the engineering profession. Some concerns have established co-operative plans with universities by which their employees may earn advanced degrees while engaged in professional engineering activities. Other firms offer summer work to engineering students with the sole hope of employing a few of them when they receive their degrees a year or two hence.

Yet the shortage continues. The deficit appears to be most acute in the fields of electrical and aeronautical engineering, although mechanical engineering and metallurgy are not far behind. Colleges are not able to train enough engineers to meet the nation's present industrial needs, and the prospects for the future are not too encouraging.

As the nation reached the peak of commencement activities, the *New York Times*, for June 19, called attention to this problem in a front page article whose head proclaimed: "Shortage of Engineers Feared Because of Drop in Science Study." Pointing out that the technical manpower shortage is of grave concern to such leaders as Howard A. Meyerhoff, executive director of the Scientific Manpower Commission, M. H. Trytten, director of the Office of Scientific Personnel of the National Research Council, M. M. Boring, chairman of the Engineering Manpower Commission of the Engineers Joint Council, and Henry H. Armsby, chief for engineering education of the United States Office of Education, the *Times* looks for the major cause of the present situation in the nation's high and college preparatory schools.

Bluntly asking, "What is behind the sharp decrease in secondary school study in science and mathematics?" the *Times* provides an alarming answer to its own query. It states that "the decline in students' interest in science has been attributed to a 'soft' educational policy, which has turned students away from the 'hard' scientific subjects and into 'easy' courses in social studies and vocational education."

The pursuit of "hard" high school subjects, for which the student really has to think, has been sidetracked to a disturbing extent. The study of algebra, geometry, trigonometry, physics, and chemistry has steadily decreased in the past five decades, while there has been an increase in the proportion of students who sample general science or general mathematics, or who take social studies, vocational education, or "how-to-live" subjects. Half the high schools in the nation do not offer chemistry and 53 per cent offer no physics, reports the *Times*. At the salaries now being paid them, competent teachers in adequate numbers are simply not available. Students are apt to receive poor science training and not much stimulation to follow professions in science or engineering.

But even in the engineering colleges, the core of "hard" topics has been whittled at in the past decade to make room for social studies or general subjects. As compared to a decade ago, less – rather than more – mathematics is permissible in some courses; in other instances engineering topics such as surveying, descriptive geometry, and engineering drawing have been removed from the curriculum or made optional. The American Society for Engineering Education now recommends that 20 per cent of the time of engineering college students be devoted to

what the *Times* would call soft subjects, and which can, presumably, be passed without much effort.

While the soft educational policy – especially at the secondary school level – was being decried, attention was also called to the fact that each year 200,000 of the most gifted high school graduates do not enter college, and another 200,000 who do, never complete their college courses. The topic was emphasized by President Killian in his "Technology of Peace" address to Alumni (page 476) and on July 6, Benjamin Fine reported in the *New York Times* that "the United States is endangering its economy through a reckless waste of gifted students." Is there a correlation between "soft" courses and "reckless waste" of talent?

In the light of present international tensions and the technological nature of our way of life, the situation is ominous. Technology is becoming more complex and difficult, not less so; more is required of the student now, than in the past, to make him a truly contributing member of the engineering profession upon graduation from college. That those with a bachelor's degree no longer meet professional engineering demands immediately upon graduation may be inferred from the increasing numbers (and percentages) of students who go on to graduate work in science or engineering, and from the increased emphasis which industry itself places upon "on the job" training after a student has his engineering degree.

Modern life demands more hard mental effort of a quantitative type, such as that which engineers and scientists receive in their professional training, and less of that kind of thinking that can – and too often does – get away with "throwing the bull."

Studies in Nationalism

NATIONALISM is widely recognized as a major force for good or ill in contemporary politics. It is a force that can warp economic development, hamper communication among scientists, impair the rationality of political decision-making, and through its wars endanger the survival of civilization. Yet we know little of the origins of nationalistic attitudes, and of the sources of mass appeal of nationalistic movements.

A systematic study of nationalism is being carried on at M.I.T. by Karl W. Deutsch, Professor of History and Political Science, with the co-operation of student assistants. Soon to be ready for publication is a book manuscript, *Interdisciplinary Bibliography on Nationalism, 1935–1953,* comprising about 1500 titles from twelve major fields, and prepared with aid from the Institute for the Unity of Science and from the Technology Press. Following an earlier bibliography by Koppel S. Pinson, which appeared in 1935, this is the second bibliography in its field; it is the first that is broadly interdisciplinary, and that includes the field of the theory of communication. Thus far, work on the bibliography disclosed that social scientists, to a surprising extent have been unaware of each others' research in different fields bearing on problems of nationalism. The new bibliography, which is organized by fields of research, as well as by geographical areas, may help to alleviate this condition to some degree.

Visual Aids

MODERN science is taking another step forward toward the successful attainment of visual prosthesis for obstacle avoidance and detection of stepdowns. The problem of devising, designing, building, and testing electromechanical aids for the blind has been under study at the Institute for a number of years.

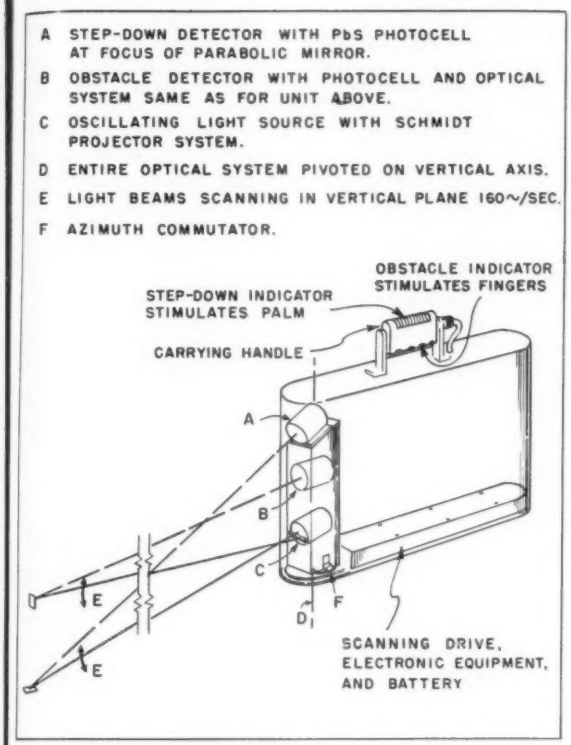
Visual prosthesis for obstacle avoidance and for giving warnings of step-downs is being studied in the Research Laboratory for Electronics. The program is under the direction of Clifford M. Witcher, and is supported in part, by the Signal Corps; the Office of Scientific Research, Air Research and Development Command; and the Office of Naval Research.

An improved model of step-down and obstacle detector, being built by Dr. Witcher and Lamar Washington, Jr., employs the basic principles of an earlier model in which radiation from a light source is projected into the path to be traversed. Reflected light, picked up by photocells, is used to actuate a signalling system, which conveys essential travel information to those using the aid. The new design represents a vast improvement over that tested a year ago, not alone in being much more sensitive and foolproof, but also in the amount of information it can convey to the user. The new model is an improvement over earlier models in that it will also provide azimuthal data, in four steps, for angles as great as 30 degrees on either side of straight ahead.

A single light source is used to project two distinct beams several feet ahead of the user. A separate photocell and optical system is used to pick up reflected light from each of these beams. One light beam and photocell is used to give warning of stepdowns, whereas the other is used to detect obstacles.

The device will be contained in a small case similar to that of a portable typewriter or brief case. The optical system, including the light source with its Schmidt projector, and photocells with parabolic receiving mirrors, occupies one end of the case, which has openings for projected and received light beams. The required electronic circuits are built in a false bottom of the case, about an inch high. The major portion of the case may still be used, as any brief case, for books, papers, or similar articles. The light source, photocells, mechanical actuators, and electronic circuits are powered by a 1.5 volt, 10 ampere-hour silver storage cell, which will provide about 20 hours of continuous operation without recharging. A single 1.5 volt dry cell, such as is used in flashlights, can be carried in the brief case and will operate the equipment on an emergency basis for about one hour, should the storage battery become discharged unexpectedly.

The entire optical system is arranged to oscillate as a unit, with a period of 1 second, about a vertical axis to an amplitude of 30 degrees each side of the neutral or center position. In addition, the light source vibrates in a vertical plane at a rate of 160 oscillations per second. The light source produces two separate beams, as shown in the diagram. The main beam, used for step-down detection, produces a rectangular spot of light 2 x 6 inches in size, at a


A STEP-DOWN DETECTOR WITH PbS PHOTOCELL AT FOCUS OF PARABOLIC MIRROR.
B OBSTACLE DETECTOR WITH PHOTOCELL AND OPTICAL SYSTEM SAME AS FOR UNIT ABOVE.
C OSCILLATING LIGHT SOURCE WITH SCHMIDT PROJECTOR SYSTEM.
D ENTIRE OPTICAL SYSTEM PIVOTED ON VERTICAL AXIS.
E LIGHT BEAMS SCANNING IN VERTICAL PLANE 160~/SEC.
F AZIMUTH COMMUTATOR.
OBSTACLE INDICATOR STIMULATES FINGERS
STEP-DOWN INDICATOR STIMULATES PALM
CARRYING HANDLE
A
B
C
D
E
E
F
SCANNING DRIVE, ELECTRONIC EQUIPMENT, AND BATTERY

Functional diagram showing the operating elements of electro-mechanical device for assuring safe mobility of foot travel for the blind.

distance of from five to nine feet ahead of the instrument. The prism projects a smaller rectangle of light more nearly horizontally, for obstacle detection.

The top photocell and optical system are arranged to pick up the signal for step-down detection and provide warning when the user is 6 to 8 feet from the step-down. The lower photocell picks up light reflected from obstacles at distances of from one to 10 feet.

The oscillation of the optical system (scanning) is achieved by means of a plunger type solenoid and crankshaft arrangement. An azimuth commutator at the base of the optical unit enables the operator to receive four sets of directional signals; 30 to 15 degrees to the right, 15 to 0 degrees to the right, 0 to 15 degrees to the left, and 15 to 30 degrees to the left. Signals from each of the four azimuthal commutator segments actuate obstacle stimulators or plungers in the handle of the device.

Warning of a step-down about seven feet in front of the operator is given by a vibration in the carrying handle and is conveyed to the operator through the palm of the hand, as the instrument is carried. The distance and general direction of an obstacle is given by vibrations of the finger stimulators. The general direction of any obstacle is indicated by that finger stimulator which is actuated. The distance of the obstacle is inversely proportional to the duration of the stimulator pulses.

The experimental unit marks an important step in the design of a simple and effective device to bring greater independence to the blind.

Blow Hot, Blow Cold

PUBLISHED writings on the subject of tooth decay — part science, part speculation, part polemics — constitute a literature that is vast, amorphous, controversial, and inconclusive. Does nutrition control the soundness of our teeth? If so, is nutrition a factor throughout life, or only during early years when tooth structure is largely established? Are variations in the bacterial flora of the mouths of different individuals the clue to differing rates of tooth decay? Is the answer increasing use of refined, rather than coarse, foods? Is it the frequency of meals?

One factor in tooth decay has been sufficiently clarified to find practical application. This is the intake of a suitable level of the element fluorine during early life, categorically demonstrated to inhibit tooth decay in many individuals. Such knowledge has led to the widespread practice of adding fluorides to municipal water supplies at a level to maintain one to two parts per million of fluorine. This practice is known to reduce tooth cavities in children by 40 to 60 per cent. But even here the polemics continue; fluoridation of water supplies is hotly contested (fortunately as a rule without success) by those who oppose compulsory public health measures on religious, political, or similar grounds, or who continue to theorize on the possibility of baleful effects, long ago disproved.

A novel note has just entered the study of modern dental ills, with the suggestion that tooth weakness may result from thermal shock, caused by taking into the mouth hot and cold foods or beverages in rapid alternation. Thus, iced drinks with temperatures near 32 degrees F. are common on summertime dining tables, and may be swallowed alternately with piping hot food having temperatures as high as 150 degrees F. Conversely, hot tea or coffee may be consumed alternately with frozen desserts.

A controlled study of such effects has been made using extracted healthy human teeth free of fillings. One hundred teeth were studied. Half were subjected to 72 thermal shocks, by shifting them between boiling water and ice water. This is manifestly more abuse than living human teeth are ever exposed to. The mouth will tolerate ice, but not boiling water. Also, pain responses protect against too violent alternations of extreme temperatures.

The other 50 teeth served as controls. They were immersed in boiling water for three-quarters of an hour, warming and cooling them slowly to avoid thermal shock. This heating was done to cancel out the effect of heat per se.

The two groups of teeth were then individually subjected to mechanical stress, by placing them on a hard concrete floor and dropping a flat-bottomed, six-pound lead block on them from a height of seven inches. Again, this is much rougher treatment than teeth in a human mouth usually undergo.

Of the 50 teeth exposed to thermal shock, 21 broke; only 11 of the 50 control teeth broke. These results are at best presumptive because of the harsh conditions of the test. Nevertheless, the study indicates that thermal shock deserves further study as a possible element in modern tooth weakness.

Book of the Tenth Census

More than 6,300 freshly buckram-bound copies of the new 1955 *Alumni Register* went into the June mails in fulfillment of orders placed by "advance subscribers;" and a limited supply of additional copies paper-bound for post-publication sales at $6.00 per copy postpaid is now on hand at the Alumni Office, Room 1–280, M.I.T.

The 1955 *Register* is the 10th edition since 1909 of this periodically published "census book" of Institute Alumni, Corporation, Faculty, and Staff; and compressed in its 642 text-pages are alphabetical listings of: 47,210 living Alumni; 11,968 deceased Alumni; members of the Corporation since 1862; 9,119 members of the Faculty and Staff since 1865; 196 officers and Executive Committee members of the Alumni Association since 1875; the 54 Honorary Members of the Association elected since 1900; and the five Honorary Members of the Alumni Council elected since 1917.

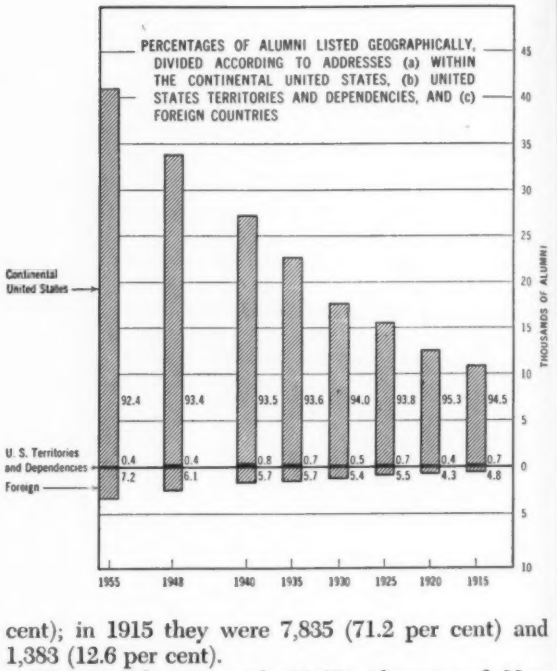
All Alumni, living and deceased, are cross-indexed according to class affiliation; and 44,274 Alumni (94 per cent of those living) are cross-indexed geographically according to their addresses as corrected to February 15, 1955.

As shown in the adjacent chart and table reproduced from the Register, the total alumni body of 1955 – numbering 59,178 persons – is 1.5 times greater than in 1940 just before World War II, and four times greater than when the 1915 Register was issued on the eve of the Institute's removal from Boston to Cambridge. To make the new 1955 *Register* of further value to readers interested in population trends, a "Statistical Summaries" section, including tabulations of comparative data obtained from listings in each of the eight editions published over the 40-year period 1915–1955, has been compiled. Illustrative examples gleaned at random from these tabulations show that:

(1) Average annual rates of increase during the seven years since the 1948 *Register* appeared have been 837 (2.0 per cent) in living Alumni, 514 (6.2 per cent) in deceased Alumni, and 1,365 (2.8 per cent) in the total alumni body; and during the 40 years since the 1915 *Register* they have been, respectively 835 (6.0 per cent), 272 (2.8 per cent), and 1,110 (7.5 per cent).

(2) In 1955, of the 44,274 Alumni indexed geographically, 40,899 (92.4 per cent) are in the United States and 3,182 (7.2 per cent) are in foreign countries, the remaining 193 (0.4 per cent) being in United States territories and dependencies.

(3) In 1948 the corresponding figures were, respectively, 21,901 (65.0 per cent) and 4,447 (13.2 per cent); in 1915 they were 7,835 (71.2 per cent) and 1,383 (12.6 per cent).



(4) Massachusetts with 10,551 Alumni and New York with 6,575 are still the leading states as in each census book since that of 1915.

(5) In the past seven years California has been gaining at an annual average of 119 (6.3 per cent). Hence, California is now third with 2,729 (6.7 per cent of the U. S. total).

(6) Pennsylvania in 1955 is fourth with 2,312 (5.7 per cent of the U. S. total); New Jersey is fifth with 2,294 (5.6 per cent).

(7) In 1955, Texas for the first time ranks within the "top ten," as tenth with 875, or 2.1 per cent of the U. S. total.

(8) Although South Dakota has doubled alumni-wise since 1948, from 8 to 16, it still ranks last on the 1955 roster of states.

(9) Of the 3,182 Alumni now living in foreign countries, 717 (22.5 per cent) are in North America, 704 (22.1 per cent) in Europe, and 510 (16.1 per cent) in South America.

(10) Canada continues to occupy first position among foreign countries with 550 Alumni.

(11) Mexico is now next to Canada with 167 (5.2 per cent of the foreign total); India is third with 149 (4.7 per cent).

(12) Venezuela's rise to sixth position among the "top ten" foreign countries has been spectacular since 1925 when its single Alumnus placed it 43d on the list.

FORTY YEAR GROWTH OF THE ALUMNI BODY: 1915—1955

1955		1948	1940	1935	1930	1925	1920	1915
59,178	**TOTAL ALUMNI**	49,620	38,525	33,903	28,643	24,802	18,046	14,788
11,968	Deceased	8,272	6,026	4,435	3,236	2,128	1,262	984
47,210	**TOTAL LIVING**	41,348	32,499	29,468	25,407	22,674	16,784	13,804
2,936	Addresses Missing	5,223	3,581	5,128	6,483	5,873	3,451	2,196
44,274	Listed Geographically	36,125	28,918	24,340	18,924	16,801	13,333	11,608

Impact of Atomic Energy on
The Life Sciences

By SHIELDS WARREN

LIVING matter is distinguished by its ability to adapt to its environment. Thus, the huge and limbless whale, well fitted for its pelagic home, steamlined, encased in insulating blubber, has been as effectively altered from the basic mammalian pattern as the night flying bat has changed to meet its own needs, substituting wings for legs. This adaptability is true of the life sciences as well as for the living matter that is their concern. The natural history of Aristotle was well adapted to the scientific environment of his time. And as the scientific environment changed, we have seen the interest of biologists swing from description and taxonomy to function and biochemistry. Atomic energy is producing a great change in the scientific environment, a great impetus to the scientific method. It has had a fivefold impact on the fields of biology and medicine. However, it has not forced uprooting and displacing of mass of knowlege developed within the past 4,000 years.

First and perhaps most important, the advent of atomic energy has required the biologist and the doctor to understand somewhat more the other natural sciences and to take them into account in his work. He can no longer afford to ignore the chemist, the physicist, the engineer. Second, by the provision of new tools that permit exact localization of the biologic processes in terms of space and time, it has provided enormous impetus to quantitative biology and to an understanding of the complex processes of intermediary metabolism. Third, atomic energy has greatly extended the types of radiation therapy available to the physician. Fourth, since ionizing radiation is no longer cooped in the hospital radium vault or X-ray room, the coming of atomic energy has greatly stimulated studies of radiation injury, its nature, prevention and treatment. Fifth and finally, it has stimulated a tremendous interest in genetics because of the profound effect of radiation upon germinal epithelium. Not only has atomic energy provided easy ways of bringing about genetic variations of value to agriculture but it has awakened man to a clearer understanding of the importance of his germ plasm, our basic heritage.

Work is done, progress is made at interfaces and this is true at the interfaces of scientific disciplines. I still remember vividly from my class in medical school the way in which the few graduates of M.I.T. in that class that had drifted into the less exacting field of medicine stood out through their ability to deal with phenomena of physics and chemistry into which they had already gained some insight. The need for radiation protection, for Geiger counters, for scintillation counters, for radioautographs have brought together the physicist sympathetic to biology and the biologist who needs modern tools in his work. Whereas the mathematics of the doctor in the past have largely been confined to being sure that the appropriate number of minims or guttae did not too obviously over- or under-fill the standard prescription bottle; now he needs to calculate dosages of radioisotopes with a fair degree of precision, juggling half lives, ergs per gram of tissue, relative biologic efficiency of different types of radiation, before he can prescribe accurately an isotopic dose.

Perhaps the greatest revolution that atomic energy has yet brought about is that in the field of understanding the metabolic processes of the body. In the past the biochemist could measure the size and weight of the body, the material taken into it and the material given off from it, but what went on within this Pandora's box – the human body – was the subject of conjecture, hypothesis and argument.

A revolution in our thinking was begun by Schoenheimer's work with a limited number of expensive stable isotopes. This has been consolidated by a tremendous volume of effort made possible with the ready availability of easily measured radioactive isotopes of most of the biologically important elements. The dynamic equilibrium of the body and its constituents has been demonstrated with a completeness inconceivable to the pioneers who first advanced this theory. While charting the interchange of atoms between biological substances, experimenters have also learned to use the radioactive substances as extremely sensitive means for detecting and measuring the individual biochemical reactions. With radioactive labelling, and particularly when combined with separation methods like chromatography, substances could be found which existed only transitorily or in vanishingly small amounts. The recognition of the new and entirely unsuspected 7-carbon sugar, sedoheptulose, as an intermediate in both photosynthetic reactions in plants and the oxidation of glucose in animals is only one example of many such findings. In this way many gaps have been filled in our knowledge of the metabolic pathways and of the interrelationships between carbohydrates, fats, proteins and other substances. Completely new reactions have also been found, which were previously undetectable by the usual methods. The enzymatic synthesis of glutathione was at first detectable only by the use of labeled substrates, and from this beginning the enzymes were eventually isolated by Bloch to give us the first set of reactions synthesizing a natural peptide. Work is now well begun on systems synthesizing whole proteins, and even though as yet no net synthesis of a protein may occur in the system, the fact of synthesis is demonstrable by the incorporation of an isotopically labeled building stone.

Of even greater interest to the biologist than the mere sensitivity and simplicity of isotopic methods

is the fact that the use of such methods is almost unnoticed by the cell. It is no longer necessary to experiment under unnatural conditions which will allow an intermediate to accumulate and be measured. The reactions going on in undisturbed cells, the synthesis of compounds in the midst of their equally rapid breakdown, can now be measured. So too can the localization of particular compounds in the cell be pinpointed by autoradiography. Work of this sort permits us at last to test the relevance of the many bits of metabolic information we have already gained for its validity in the whole, living cell or organism.

The stimulus provided by atomic energy to nuclear physics has been a great boon to radiation therapy. Several of the radioisotopes have already proved their value as internal emitters, notably P_{32}, I_{131} and Au_{198}. Radiocobalt has largely replaced radium, and by its greater specific activity has made it possible to have much more powerful sources than could have been obtained from radium alone. Supervoltage radiation, although not directly concerned with atomic energy, has been tremendously advanced as a result of the stimulus to the field of nuclear physics. Neutron beams from cyclotrons or reactors have been utilized to a limited degree for the treatment of certain types of cancer, notably brain tumor, and the effect has been enhanced by the administration of localizing substances such as some of the boron compounds that enhance neutron capture by the tissues.

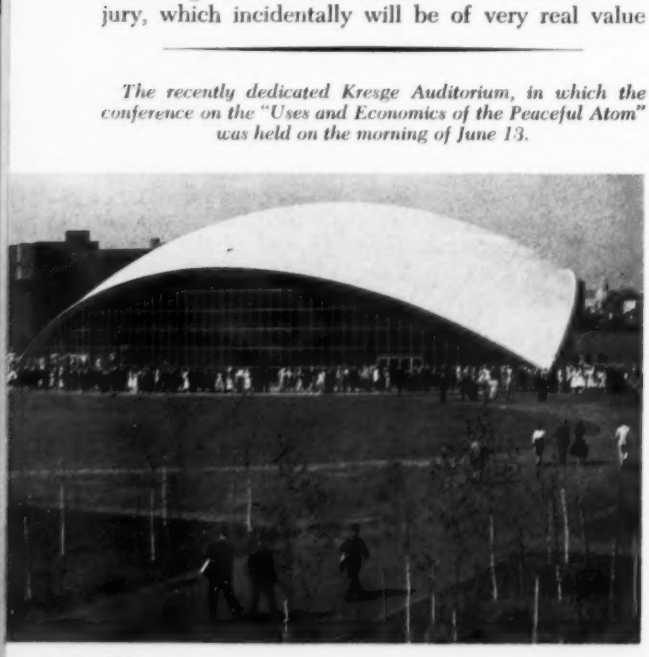
Radiation injury, long of esoteric interest (my own had been aroused some 30 years ago by the changes seen in the hands of the pioneer X-ray workers) has become a concern not only of the physician but of the reactor engineer, the experimentalist using radiation source in his laboratory or the military man concerned with determining kill radii or means of protection of his own personnel. Fortunately, very active research is going on in looking toward better knowledge of the mechanisms involved in cell injury, which incidentally will be of very real value in the radiation therapy of cancer, and in the finding of remedies for radiation injury in its acute and severe forms. Through experiment and experience increased information is being gained as to permissible doses of radiation. In the meantime the work of the biophysicists, radiochemists and engineers has given us much information as to how to live safely with radiation and how to handle dangerous amounts of material. In the refining and use of somewhat under a pound of radium accumulated in the world for medical purposes prior to World War II approximately 1000 people were involved and 10 per cent of them died or suffered serious injury as a result of the radiation that they received. In the atomic energy industry on the other hand which handles radioactivity equivalent to thousands of tons of radium and with hundreds of thousands of man years of experience, there have been only two deaths from radiation and barely a score of injuries from radiation.

The global distribution of the fallout from atomic explosions and the drama of the rain of radioactive ash on the Japanese fishing boat together with the availability of very delicate instruments for the detection of radiation have brought the problem of chronic radiation effects to the forefront. Fortunately, the global levels of radiation have been such as to be of no significance to health.

Radiation has proved to be a very powerful means for the production of genetic mutations. Observations on plants, animals and man and controlled experiments in animals and plants demonstrate clearly that at any time a spontaneous genetic mutation can occur. Most of these mutations tend to act unfavorably on the function or development of the individual produced. These spontaneously mutated genes, largely recessive, have accumulated over the ages in appreciable numbers in all populations – plant, animals and man. The presence of these mutated genes in the germ plasm accounts for a considerable number of the stillbirths and congenital malformations encountered in the human population. The mutations due to radiation are predominantly detrimental, although in agriculture careful selection of mutated varieties of plants has made it possible to produce improved crops. Since the effects of radiation on germ plasm are cumulative, it is inevitable that any increase in the background radiation such as the slight increase produced in some regions by fallout from atomic weapons tests as well as from the industrial uses of atomic energy will result in additional mutations in human genes. However, only a small number of these mutated genes will produce any noticeable effect even in the first generation. Only as centuries of the atomic age pass will most of these radiation mutated genes produce change and then usually will bring about some minor or possibly major impairment of development or function in the individual concerned. Because many such individuals who have already become carriers of mutated genes in the population as a result of the accumulation of mutated genes over the period of development of man, it will be impossible to recognize the persons added as a radiation effect.

(*Concluded on page 528*)

The recently dedicated Kresge Auditorium, in which the conference on the "Uses and Economics of the Peaceful Atom" was held on the morning of June 13.



Impact of Atomic Energy on Our Economy and Way of Life

By T. KEITH GLENNAN

THE topic assigned to me is a formidable one indeed. Perhaps by reducing the problem to bare fundamentals, however, we can examine its various parts briefly and then develop a rational and useful picture of the probable effects of increasing use of nuclear energy on our social and economic organization. In discussing this as a method of approach with a colleague a few days ago I was the recipient of this sage advice – "If Einstein could reduce the fundamental relationships of energy and matter to the simple formula – E equals MC^2, there is hope that you can cover, in a matter of 30 minutes and in broad outline only, the impact of atomic energy on our economy and way of life." Thus challenged – and with the help of my crystal ball and, perhaps, some measure of common sense – it seemed to me that I might best serve your interests by discussing the peaceful atom in terms of present industrial activity, in terms of present governmental activity, and in terms of the important problems that may impede progress toward the ultimate goal of useful and widespread exploitation of the nuclear field. Finally, with your indulgence, I'll try to look ahead a bit and try to suggest the possible course of events for the future.

If we are going to look at the economy as it may be affected by industrial and governmental interest in the atom we can most easily approach the subject by speaking in terms of "bulls" and "bears." The economy either expands or it contracts. Business tends to boom or to bust. There is either prosperity or depression or as we have come to view it in these latter days – recession. Seldom does one find the economy static. Perhaps its most dominant characteristic is that – as J. P. Morgan once said of the stock market – "it will fluctuate." Where does the industrial atom fit into this picture? So far as one can see it is on the bullish side, some would say strongly so. Measured against the situation existing two years ago when the activity was essentially zero even a conservative minded person would have to say that there is optimism in the air. Caution, born of ignorance growing out of a tight security program, is being swept aside by aggressive, competitive risk-taking born of the 1954 change in the Atomic Energy Law and the optimism supported by faith in the ability of the engineer to solve the technological problems which remain as the principal obstacles to economical use of the atom.

The evidences of this bullish tendency on the part of industry are becoming impressive. This audience is made up of people of affairs who must keep abreast of important developments in the industrial and political world. There is no need here for me to do more than list the more important actions taken by industry to further competitive non-governmental involvement in the burgeoning atomic energy business. Such a list would include the announcement of the building of a 236,000 kw 55 million dollar atomic power plant by Consolidated Edison of New York using private funds and with Babcock and Wilcox as the prime contractors; the submission to the A.E.C. of proposals for the building of atomic power plants by four utility groups – three privately financed and one public power district – with governmental participation estimated to amount to 10 per cent to 20 per cent of the total cost and restricted to the research and development phases of the projects; the privately financed $6.5 million materials testing reactor to be built by Westinghouse; American Machine and Foundry's $1.5 million research reactor; plant additions now under way by Babcock and Wilcox and Combustion Engineering for the sole purpose of building reactor components and equipment; and Standard Oil Development's construction of a laboratory for research in nuclear science. North Carolina State, Penn State, the University of Michigan, Batelle and Armour Institutes and your own great M.I.T. are building or will build research reactors using funds provided by industry and individuals. Perhaps one of the most interesting instances of enterprise is that of the offer made by both Foster-Wheeler and by Babcock and Wilcox to design and build large scale nuclear power plants at a guaranteed cost per kilowatt that exhibits substantial faith in the future of the atom business.

Now, one of the really significant facts to be kept in mind is that the power proposals made to date are based on as many different reactor concepts as there are proposals. And yet each is backed largely, indeed, in most instances, wholly by private capital. Since none of these units is expected to be economically competitive with the average conventional thermal plants, it is apparent that competitive industry is using risk capital to speed the technological improvements necessary to the rapid development of a truly competitive nuclear power industry. Could there be a more solid example of optimism and bullish activity?

But there is additional evidence of confidence being displayed by the American industrial community. The Atomic Industrial Forum is an organization of about 300 industrial concerns and research institutions. It is devoted to fostering the development of atomic energy for peaceful purposes. In April of 1954, the Forum with the co-operation of the Atomic Energy Commission, undertook to survey the plans of American industry in the atomic energy field over the course of the next 10 years. Some 400 companies representing about 75 per cent of the dollar volume of the present atomic energy industry were surveyed. Here is a brief of the significant findings

of the survey: 1) Industrial organizations and privately financed institutions in the U.S. plan to spend $300 million of their own money during the next four years in atomic energy research and development including capital facilities. 2) By 1963 the manufacture of components will probably be a business grossing $700 million per year. 3) By 1965, it is estimated that between 3 and 7.5 billion dollars will have been invested in the U.S. in reactor construction. That is a wide spread to be sure, but even the lower estimate represents a substantial plant investment. About half of this volume is expected to be represented by propulsion reactors. 4) By 1965 reactor operation may call for an annual consumption of 8,000 metric tons of natural uranium and a possible total of 26 tons of U-235. 5) Also by 1965 atomic energy developments, both government and industrial will call for a total of 30,000 to 40,000 scientists and engineers, or about double the number in both categories today. 6) Large reactor power plants will become economically competitive between 1962 and 1965.

On May 23 and 24 the Forum held a members meeting in New York to discuss the meaning of the findings of the survey. Typical comments heard in the halls and reported in the Wall Street Journal included this one by Carroll Wilson, Vice-president of Metals and Controls Corporation of Attleboro, Mass. – "there will be large risks and commitments, but the stakes are big." By R. C. Freeman of General Electric – "we're in this business for the long pull." And by Leonard Cronkhite, President of Atomic Instruments Company, as he said, "you've got to stay at the head of the parade, constantly developing new products and seeking new markets." No sign of pessimism here, is there?

The government, too, is not without an attitude of bullishness toward the future of peaceful use of the atom. It was this confidence, prodded somewhat by industry and the Congress, that was the major reason for the $200 million five-year reactor development program launched by the Atomic Energy Commission last year. The purpose of this program is to push five different types of power producing reactors through the successive phases of research, development and successful operation. Add to this the submarine and large ship propulsion units, the aircraft propulsion program, and the package power units for the Army and you have a substantial undergirding of the industrial program by continued governmental research and development and prototype construction of a variety of types of power reactors. And the government is committed to a continuation of this support although it will diminish with time.

President James R. Killian, Jr., '26, of M.I.T., President T. Keith Glennan of Case School of Technology, and President Richard S. Morse '33, of National Research Corporation.

At this point let me say that, personally, I take great satisfaction in the present state of affairs. During and immediately following my term as a member of the A.E.C., I urged upon industry an aggressive interest in atomic energy. Money talks – usually – and the expenditure of money by the early study teams and impressive technological progress made within the Commission laboratories combined with other and important factors to convince the Congress and the Commission that the time had come for a new look at the basic atomic energy law. It was not always that way! As recently as the spring of 1952, I can remember a member of the House Appropriations Committee demanding that he be assured that the A.E.C.'s budget contained no money for industrial atomic developments! How the atmosphere has changed in three short years!

All this activity is obviously based on an optimistic view of the future of atomic energy. The optimism is strong and widespread. Even the government, which is not usually inclined to prognosticate, has talked in terms of from two to ten per cent of the total electrical output in the U.S. being produced from atomic fuels by the year 1975. This could mean as much as 40 million kw of installed capacity – an amount equal to 40 per cent of the total installed capacity in this country in 1954. It is almost fair to say, that currently it is fashionable today to be optimistic. As a matter of fact, much of our foreign policy today is based on the optimistic assumption that the atom is really going to amount to something. For example: there is the entire atoms-for-peace program, with its Geneva Conference, its atomic-powered peace ship, its bilateral agreements with our friends overseas, and its plans to set up an International Atomic Energy Agency. Today's optimism is reflected in the stock market, where the shares of companies with publicized atomic energy activities sometimes jump as much as 15 points and more in 48 hours on the basis of announcements and even rumors of mergers, contracts and plans.

In the light of all this, it would be very easy to stand here today and say atomic energy will have an enormous impact on our economy and way of life. One could speak of economic power, of package power plants changing the face of the land and the lives of people in remote regions of the world, of a new chemical industry built on the use of radiation, of a new food industry built on radiation sterilization techniques, and of a myriad other beneficial applications ranging from the mastery by man of the photosynthetic process to the elimination of disease. The problem, however, is to find where in this welter of

dreams reality lies. Is the current optimism just a passing fad, founded on hopes and nurtured on publicity, or is it something more substantial? Is it based on a realistic and hard-headed evaluation of the known technological and economic probabilities?

Before going on, I think I should make clear my own position. I think it would be fair to say that in regard to atomic energy I am an optimist. But I am what I like to think of as a realistic bull, or a bull whose optimism is tempered by a real respect for the enormous problems ahead. Another way of putting it would be to say that I believe more in what I would call the atomic evolution than I do in the atomic revolution. So in the hope that I have made clear my own sincere belief in the future of atomic energy, let me – to keep the record straight – list just some of the obstacles that must be overcome by hard work and much imagination before we can honestly hope to arrive in the promised land.

Let's begin with uranium – the raw ore. Here is one place where the optimists of the past have already been proved right. There is more commercial grade uranium known to exist today than almost anyone believed possible 10 years ago. In passing, let me pay tribute to Jesse Johnson, Director of Raw Materials of the A.E.C. and to Commissioner Thomas E. Murray whose optimism and stubborn pursuit of increased supplies of uranium must be acknowledged as one of the major contributions to the health of our great atomic program today. The uranium mining industry in the U.S. virtually non-existent following the war, is now a $100 million a year industry. It is of the same order of magnitude in Canada. Enormous quantities of uranium are now being extracted from gold residues in South Africa. The rich Shinkolobwe mine in the Belgian Congo continues to produce. Important deposits are being found in Australia and elsewhere.

But much of the exploration that led to these discoveries, and nearly all of the major production of the world, can be attributed not to any normal, peaceful, civilian industry, but to the fact that there has been an almost insatiable weapons market for uranium. Prices have been guaranteed, liberal bonuses and allowances have been paid. The guaranteed minimum price in the United States expires in 1962. One problem ahead is what happens after 1962. Even the optimists have questioned whether the civilian industry will be able to absorb uranium at the present rate of world production until after 1980. Should the government continue its guaranteed prices? Really, there should be only one reason for doing this and that is the weapons program. But who can say for sure what the weapons market will require? Even if the military services thought they knew today what they would need in 1962 and beyond, how can they be sure in a situation fraught with such unknowns as the results of international political maneuvers, technological break throughs, and the opinions of yet-to-be-appointed-or-elected public officials? And the mining industry will need to know what governmental policies on ore procurement are to be – long before 1962. This is indeed a difficult problem that can be resolved only within the A.E.C.

The real problem here is the development of a price guarantee and buying schedule to be effective after 1962 that will tide the uranium mining industry over until the power and propulsion demand can replace the military demand that has formed the basis of the industry in the past. There are other problems – among them ore processing, feed materials processing, full fabrications, materials development, fuel reprocessing and waste disposal. Listen to Glenn Seaborg speaking at the Forum-Stanford Research Institute meeting in April in San Francisco: "In my opinion a limit to the extent to which atomic power can be used in the future will be set by the ultimate solution to the waste disposal problem, and here, it seems to me, the path for the ideal solution must lie outside of any ideas presently contemplated." These are the tough and, in some cases, nasty jobs that are just as important, in their own way, as the actual nuclear reaction itself so far as the economic production of heat power and radiation is concerned. There are other problems too, not all technological. For example, there is the problem of insurance. The potential hazards of atomic energy are enormous. No one expects a reactor to have a catastrophic accident, but owners and operators want to be covered if it does. But no insurance company will write, as yet, the policies involved.

In summary, it seems clearly evident that determined attempts are being made to industrialize the atom within the framework and using the methods of our traditional competitive enterprise system. What I have done thus far in this discussion is to bring together elements of the atomic picture that should be known to all who will pause and will read. I have tried to paint a sort of unfinished picture with these elements – unfinished because of the problems that remain to be solved – unfinished because of the international political scene which continues to make the explosive potential of the fission and fusion process still the paramount objective of our national atomic energy program. There is no question but that we are embarked on an imaginative journey to new horizons but patience, diligence, courage and constructive planning will be needed in full measure if we are to achieve the great goals envisioned by President Eisenhower and our statesmen – goals of peaceful progress for all peoples through the gateways opened by the split atom.

In some ways I think I have strayed a bit from my topic. I have told you about the state of the economy as it relates to the development of an atomic energy industry. I have not ventured to say much about the impact of atomic energy on our total economy and our way of life. But I will try now, as I conclude, to suggest some thoughts on the more philosophical aspects of this subject.

Our way of life once included an almost automatic response to threats of violence to the person or property of an American citizen. Today, because of the involvement of civilian populations in modern wars and because of the destructive powers of the atomic and hydrogen bombs, we try to find peaceful solutions to such problems. National tempers are less prone to flare at the slightest provocation than was

(*Continued on page 530*)

A Report on M.I.T. Progress Emphasizes

The Technology of Peace

By JAMES R. KILLIAN, JR.

MY ASSIGNMENT today is to give you a brief report on recent and impending changes at M.I.T. and to relate these local developments to their national or international setting. I also wish to give special emphasis to the ways in which this institution is sharing in the great responsibility for mobilizing science and education to further the peaceful objectives and augment the strength of the free world. I thus pitch my remarks in the same key as this morning's impressive symposium.

Last month we announced that the Corporation had voted unanimously to raise the tuition at M.I.T. from $900 to $1100 per academic year, effective with the opening of the summer session in 1956. This decision was reached reluctantly but with a deep conviction first, that it was an essential move to assure M.I.T.'s independence and strength and, second, that it was also in accord with a growing national attitude that the privately controlled institutions must meet their financial problems squarely and creatively.

The private institutions must not deny themselves the remedies available to other organizations in our society in a period of rising costs and high taxes. They must reject and replace the sorry subsidy of balancing their budgets by underpaying their faculties. They must aggressively seek increased gifts and grants from a greater number of sources and at the same time improve their budgets by removing the deadwood from their curricula and the dead hand of archaic methods from their management. If they are to continue to be pacemakers and standard-bearers of higher education, they must expect to help themselves and thus justify help from others. These are the conditions of survival and the requirements of leadership. To meet them, the private colleges must revise obsolete financial policies. They must ask parents who are able to pay a higher portion of the costs of their young people's education and at the same time increase institutional assistance for students who need help. They must move in the direction of asking those who can to pay and those who can't to be generously helped. Too many young people of ample means are being subsidized in college, while too many of limited means are being inadequately helped. This condition arises for two reasons: (1) a tuition policy that does not adequately take into consideration the ability to pay and (2) a scholarship policy that gives aid to those who do not need it.

The misuse of scholarship funds for the purpose of recruiting talented young men and women, without due regard to their needs for financial aid remains a powerful factor in continuing to promote confusion in the minds of the public as to the true purpose of scholarship assistance and the high purposes of education. It is encouraging that this year almost 100 colleges and universities have joined in a common program aimed at a solution of this problem. It is highly necessary that everyone, including Alumni, parents, and secondary school people understand that financial assistance from colleges is related to need as well as scholarship. Prizes and other forms of recognition for intellectual achievement are important, but under present conditions, scholarships must be limited to those able students who need financial aid to go to college. These views in regard to the financial policies of private colleges have motivated M.I.T. in increasing both tuition and scholarships beginning in 1956. Even after the increase, the tuition paid by M.I.T. students will cover less than half the cost of their education.

When the new tuition goes into effect, we expect to extend scholarship aid to more students at M.I.T. and to increase the average award per student as well. While further gifts are urgently needed to provide scholarships, it is indeed encouraging to have the increase in scholarships at the Institute coming from industry and from personal gifts and bequests. These scholarship funds, augmented by additions from unrestricted funds, will make available an increase of better than 50 per cent in the funds for undergraduate scholarships in contrast to the 22 per cent increase in tuition.

Along with an increase in tuition and student aid, we seek an increase in gifts and grants. Under the direction of Alfred P. Sloan, Jr., '95, Marshall B. Dalton, '15, and Robert M. Kimball, '33, Secretary of the Institute, we have a large campaign for the Compton Memorial Laboratories under way. In addition, we are moving to extend the annual giving concept of the Alumni Fund to other groups. We are maintaining at a very gratifying level the Industrial Liaison Program of corporation grants. We are conducting a bequest program. In every possible way, we are seeking to broaden the base of the Institute's support. This year, for example, our gifts and grants will come from 31 foundations, 170 companies, and 12,000 individuals and other givers. Thus we average over a thousand gifts a month, small as the average gift may be. From this great variety of sources M.I.T. will receive during the current fiscal year approximately six million dollars, compared to the five million received last year.

This total we announce with gratitude and gladness, but our report would not be complete without a footnote to remind us that the dollar "ain't what she used to be." What was a million dollars 20 or even 10 years ago represents in purchasing power only about a half-million dollars today. We also need to note that M.I.T., in response to the national need,

has increased its student body from 3,100 to over 5,000 students since the war, with a proportional increase in the size of its physical facilities, and the need for a proportional increase, measured in constant-value dollars, in its endowment, which it has not yet achieved. I call attention to these facts to point out why, in terms of present-day dollars, we must increase both tuition and gifts.

And now let me report specifically on the special effort to raise seven million dollars to build a nuclear reactor and a physical sciences building to aid vital programs of basic research and teaching and to stand as a fitting memorial to Karl Compton. It is especially appropriate that we memorialize Karl Compton this way because he felt these facilities to be urgent needs, and they will further those fields he was interested in as a scientist. With over four million dollars pledged or given, we hope shortly to come close enough to our goal to start construction of the physical sciences building and sometime during the next academic year on the reactor. Both of these facilities will serve to augment the Institute's facilities for pure science and basic research and are thus in accord with the growing national conviction that basic science and basic research need greater emphasis and support. The reactor will also provide us the necessary laboratory for training the new breed of engineer required by industry to exploit the peaceful atom.

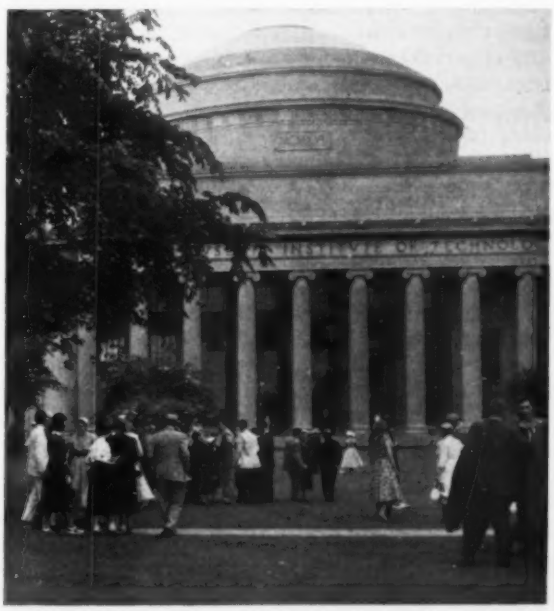
Because of the special interest it commands, and in the light of the morning's conference, let me give some details about our reactor. It will have nothing to do with bombs. It will be non-secret and dedicated to the unrestricted advancement of knowledge and the peaceful use of the atom. It will be a domesticated kind of reactor for campus use. We have investigated the types of reactors whose performance has been demonstrated in A.E.C. laboratories and have decided that one generally similar to the CP-5 reactor of the Argonne National Laboratory best satisfies our requirements with respect to safety, usefulness, and cost. It is generally agreed that such a reactor is one of the safest known. It will be housed in a gas-tight steel building. It will be operated to produce heat at the rate of 1000 kilowatts. At this power level it will produce a flux of thermal neutrons as high as any other university reactor in the United States. It will be operated at temperatures under 50 degrees Centigrade, and is not intended to produce useful power.

Our preliminary plans have been reviewed by the A.E.C.'s Advisory Committee on Reactor Safeguards, which has agreed that our proposal to build a reactor of this type and power level for campus use is reasonable. We are now completing detailed specifications and will submit them to the Committee for formal approval in the late summer.

This reactor will be an integral part of our educational program for students of nuclear engineering. It will be used in a great variety of research programs, including studies of the solid state by means of neutron diffraction, reactor development studies, production of radioactive isotopes, activation of engineering test materials, catalysis of chemical reactions by radiation, sterilization of food and pharmaceutical products by radiation, acceleration of biological mutations, and cancer radiation therapy. Through the agency of this reactor, M.I.T. expects to make substantial contributions to the beneficent uses of atomic energy. It expects thus to take its share of the responsibility for keeping the United States in the lead in realizing the immense potential of atomic energy to improve the health, welfare, and prosperity of mankind. Our educational program in nuclear engineering is evidence of our policy to move into important new fields of technology, as opportunities and needs open up.

While all that I have said so far has a bearing on the quality and vigor of our educational program, let me now turn to a specific example of an important educational experiment which reflects our search for new patterns. This is what we call the double major, or Course XXI, a new undergraduate course of study which has been unanimously approved by the Faculty and for which the Rockefeller Foundation has just made a grant of $300,000 to aid us in getting it under way.

This course is precedent-setting for the Institute since it is a program in general education — a course polarized about science or engineering, but still general in aim and scope. About 40 per cent of the four years will be devoted to the humanities and social sciences — about twice as much as now provided for in any existing Institute program — the remaining work, of course, being in the fields of science, engineering, or management. This course will lead to a bachelor's degree without specification, but it is so designed, and this is a very important aspect, that a student can come for a fifth year and obtain a degree with specification in any one of our professional courses. This new curriculum promises to have many important values for the Institute. It will serve to give our School of Humanities and Social Studies a



The dome of Building 10 dominates the Great Court as Alumni return to hear President Killian's report on the state of M.I.T.

course of its own and thus to give the teachers in this school more of a professional stake in our total educational assignment. It will help to attract to the Institute, we hope, more of the type of youngster who wishes a professional education coming as a sequel to a general education or who has a bent for human relations and the art of leadership. It may well serve to set a new pattern in American engineering education, and I believe this pattern to be a better one than a continuous five-year program leading to a professional degree. Finally, the program reflects the responsibility accepted by this institution of laying great stress upon a broad general base for the education of scientists and engineers.

At this juncture in our national life, we have urgent need for more scientists and engineers, more Comptons and Bushes and Conants, who can build bridges of understanding between the domain of science and the domain of non-science. We need scientists and engineers who are deeply conscious of the issues and values in our society and who can, as a result, be influential leaders in the political and public life of the nation. We believe that education can help to motivate and prepare more engineers and scientists for this kind of public service and broad outlook. We in the field of science and engineering education have a special need today to consider the position of the scientist and engineer in relation to public policy. There is some inclination to consider the scientist as so much of a specialist that he has no qualifications for speaking up on public policy. Scientists have been attacked for speaking up on public policy simply because they were scientists. There is almost a hazard that the scientific and technological specialist will be muted as a voice in our public councils.

In an age of science and technology this is doubly unfortunate. Public policy needs to have from science an understanding of how science affects policy. And the scientist should have the same prerogative, no more, no less, than other professional men, lawyers, doctors, ministers, teachers. He also has the same obligation as do they to speak in an informed and responsible manner on public matters. But just because a man is a scientist or engineer should not disqualify him from speaking on an equal basis with other professional men in regard to the great questions of our day. The very nature of many of the questions, arising as they do out of the activities of scientists and engineers, makes it imperative that the scientist and engineer speak as citizens on an equal footing with citizens of comparable education from other walks of life. It is vital that they be able to speak out of their knowledge as scientists on the meaning of science to our society. This is important if we are to maintain a favorable environment for technological advance and if the nation is to deal wisely with the great technological forces of our time. Of course, this condition I describe has the same roots as those security and loyalty policies which have been so inimical to science and to freedom of thought. It is to be hoped that the pendulum has begun to swing the other way, now that the Supreme Court has given it a nudge, however slight, in the right direction.

Shortly after receiving the Rockefeller grant for new teaching programs in the social sciences and humanities, we received another substantial grant in a related field and which illustrates our progress in building into an institute of technology one of the best liberal arts groups in the nation. The Carnegie Corporation has authorized $150,000 to enable our Center for International Studies to undertake a three-year study on American Society in the World Setting. This study will seek to find ways of making more clear to ourselves and to the world the unique aims, ideals, and substance of our society and the Great American Dream. In seeking to throw more light on the industrial and technological influences in American society, the project will supplement studies in our School of Industrial Management.

These two grants, the Rockefeller and the Carnegie, to new programs in the School of Humanities and Social Studies serve to emphasize how an institute of technology widens its boundaries in response to the increasing role of technology and technologists in both national and international affairs. It was said of the Athenians that it was their destiny "to make gentle the life of mankind." It has been said of the Western world that its tradition has been to "do something for mankind." I venture to suggest that a flourishing science and its benign use give our American society powerful means to further both of these great humane traditions. Certainly our institutes of technology with their freedom from encrusted academic tradition have before them an opportunity for a major advance in education by demonstrating that science and technology are essential and natural partners with the other great professions in the furtherance of these noble social and cultural objectives.

The effort to relate our M.I.T. education to all relevant domains of thought and creative activity has been quickened during the year by the use of the Kresge Auditorium and the M.I.T. Chapel. As Professor Bush-Brown wrote in the Boston *Herald* yesterday (June 12) these boldly innovating buildings affirms three important beliefs: (1) that the heart of religious worship consists of meditating about questions of value, purpose, and destiny in an environment that gives insistent urgency to those questions; (2) that environment must be organized artistically unless our educational attempts of teaching the next generation about order, neatness, and values that are nonutilitarian are to be thwarted; (3) that specialties in engineering and the humanities must be synchronized in one unified art of creativity in order to give our civilization meaningful shape.

May I now turn to our problem of enrollment at the Institute, and discuss it in relation to national and international trends in the demand for education. I have already noted that M.I.T. has accepted a large increase since the war. Next fall our enrollment may exceed 5,700 compared to 3,100 in 1939–1940. This increase reflects our response to the world scarcity of scientists and engineers together with the increased scope of the Institute's program. In considering what we do from now on, we are acutely mindful of the tidal wave of students now rushing through our

(*Continued on page 510*)

The Baccalaureate for the Class of 1955 was held, for the first time, in the Kresge Auditorium. Members of the Faculty are gathered on the stage as Dr. Eliot gives the address.

"Freedom is a Noble Thing"

By **FREDERICK MAY ELIOT**

BACCALAUREATE ADDRESS

ABOUT a month ago, this auditorium in which we are gathered and the M.I.T. Chapel close by were dedicated in an impressive and moving service; and one of the most stirring parts of the program was the "Canticle of Freedom," the composition of which had been commissioned for that occasion, and the first performance of which was given by the Symphony Orchestra, the Glee Club, and the Choral Society of the Institute, under the direction of Professor Liepmann.

In the writing of that deeply moving work of art two great artists collaborated – Aaron Copland, who represents the creative genius of modern music as vividly as any living composer, and John Barbour, the father of the poetry of Scotland, from whose most famous piece, written in 1375, the words of the Canticle were taken. Between these two artists lies a span of nearly six centuries, and during that period almost everything we think of as characterizing the "modern" world has come into existence.

Almost everything, but not quite; for the word "freedom" expresses something that has not changed in any of its essential qualities since the Battle of Bannockburn which John Barbour celebrated in his poem about Robert Bruce. Indeed, all that is essential in the concept of freedom as we use the word today goes back far beyond the Fourteenth Century, for it belongs to the oldest of all human traditions. One of our own Cambridge poets, writing of the struggle of his own generation to win freedom, spoke of that effort as "One new word of that grand *Credo* which in prophet-hearts hath burned/ Since the first man stood God-conquered, with his face to heaven upturned."

When, therefore, in the dedication of its new center for the spiritual life of an educational institution of the mid-twentieth century, this Institute celebrated in terms of art the concept of freedom, it affirmed its allegiance to one of the few timeless values in all human experience. All that I have to say may be regarded as a footnote to that affirmation.

"Freedom," wrote John Barbour, "is a noble thing." It is noble, first of all, because of what it has cost, in terms of heroic sacrifice, eternal vigilance, and sheer stubborn resolution, through all the centuries. We think of the Maccabeean martyrs, of the early Christians who defied the power of Rome for the sake of the liberty wherewith Christ has made them free, of the non-conformists harried out of England and seeking refuge on these shores; we think of the men who fought at Marathon and Lexington and on the beaches of Normandy; we think of the men who sweated out with infinite pains the basic principles of a political system by which freedom might be preserved and made effective in a changing world; we think of the quiet scholars who refused to submit and thus laid the foundations for academic freedom, of the artists in every medium who suffered contumely and poverty for the sake of a new word and the right to speak it.

We can sum up the whole record in the sober words of William Brewster, written of a little company who regarded themselves as the Lord's free people and were resolved to maintain their freedom at any price: "And that it cost them something this ensuing history will declare." Freedom is a noble thing because of what it has cost.

(*Continued on page* 516)

The March of Mind

By SIR ROGER MAKINS

COMMENCEMENT ADDRESS

PEOPLE nowadays do not often read that witty and pungent English writer, Thomas Love Peacock, who flourished at the time of the industrial revolution in Britain. But I am one of his fans, and I always remember the following passage in his novel, *Crochet Castle:* "God bless my soul, sir!" exclaimed the Reverend Doctor Folliott, bursting, one fine May morning, into the breakfast-room at Crochet Castle, "I am out of all patience with this march of mind. Here has my house been nearly burned down, by my cook taking it into her head to study hydrostatics, in a sixpenny tract, published by the Steam Intellect Society. – My cook must read this rubbish in bed; she dropped suddenly fast asleep, overturned the candle, and set the curtains in a blaze. Luckily, the footman went into the room at the moment, in time to tear down the curtains and throw them into the chimney, and a pitcher of water on her nightcap extinguished her wick: She is a greasy subject, and would have burned like a short mould."

Now ladies and gentlemen, it is a far cry from the Steam Intellect Society to the Atomic Intellect Society, if there is one. But the quotation will serve well enough to give me a title for my address, "The March of Mind," and to fix a point of comparison with the contemporary scene. For it is essential to try to stand aside, every now and then, and relate what is happening in the world around us to the broad stream of history. And what better moment is there than an occasion like this, at a famous institution of learning and research, when the representatives of the older and the younger generation are gathered together so that the former can wish Godspeed to the latter on the threshold of their active lives?

In these two generations, which are bridged by my own life's span of half a century, we have had, in the field of politics, two world wars, and two major revolutions, in Russia and in China. In this period we have withstood massive assaults on the fundamental beliefs and structure of our society and of our civilization. I say "our" because your American political and social organization is derived from European, and particularly from British models, and the same political and legal principles are enshrined in the great documents which are the charters and the title-deeds of our liberties. Again in this same period, and proceeding concurrently, we have witnessed an important stage in what the grandson of Charles Darwin has called the Scientific Revolution: the progressive mastery by man over the forces of nature. I am not forgetting Archimedes, or Newton or Faraday or any of the other famous names inscribed on your campus, when I suggest that the 20th century's achievement in the speed and range of scientific discovery and technological advance has never been surpassed.

Without overlooking the contributions of other countries, it is a fact, due partly to the circumstances of World War II, that much of the effort, and perhaps the major part of the progress, has been made in the United States and in Great Britain. It is sometimes said that Britain tends to be more prolific in ideas and basic research, while the United States is more adept at industrial application and production. Certainly the history of the early development of radar, television, penicillin and the jet engine bears this out. But however this may be it is equally certain that nothing can be more to our mutual benefit than the continuous cross-fertilization of thought and information between our two countries, and we can only lament any legislative barriers which, in some vital fields of research and development, may still hinder this beneficent process.

Some people today may be tempted to take the same recalcitrant attitude as Thomas Love Peacock to the impact on our own society of more recent advances in science, such as the development of the internal combustion engine, and the increase in the rate of communications in general. These have led to an almost frenetic acceleration of the tempo of modern life. They have stepped up the pressure on the individual, particularly the individual in the public service or in a position of authority in industry. They have threatened to make further inroads into the study of the humanities, into the time available for contemplation and reflection. Today we are all of us jet-propelled and wired for sound, and it is no wonder that some people may be inclined to complain with Peacock's contemporary, Wordsworth, that "The world is too much with us."

But no one in this audience, I imagine, will be disposed to resist the march of mind. There can be no question here, on the banks of the Charles River, of wishing to dam the flow, the free flow, of scientific enquiry, wherever it may lead, whether it be to a hydrogen bomb or to a vaccine against poliomyelitis. There can surely be no disposition to check the march of science and technology in a free society. Yet if we accept these premises, we also accept a great challenge; how to use the effects of scientific and technological advance in raising our standards of living, moral as well as material; how to relate and apply them in our policies, national and international; how to integrate them in our political and social philosophy.

Let me first glance again at the point at which we stand in relation to the history of our time. Ten years ago we were between V.E. Day and V.J. Day. We

stood victorious against totalitarian aggression, but with the nations of Europe and Asia at least, both victors and vanquished, impoverished and exhausted. The victors followed a pattern, familiar from Vienna to Versailles. We tried to constitute an international organization which, while avoiding the complications of a world government, would provide for collective defense, and for collective action not only in the political field, but in economic and social affairs as well. According to a pattern also only too familiar, the victors soon fell out among themselves. Having overcome one form of totalitarian tyranny, we found the world again threatened by another brand, supported this time by the might of Soviet Russia, which had not dismantled its armaments after the war. Thus the United Nations was prevented from fulfilling all the intentions and hopes of its founders; and a general line of conflict, geographical and doctrinal, was drawn between nations grouped around what had become the two great centres of power, the United States and the Soviet Union. For the United States, by virtue of its huge preponderance of resources, both economic and military, had assumed, reluctantly but inevitably, the leadership of what came to be called the free world.

At the same time, the pressure of wartime necessity had led to those far-reaching advances and scientific developments in Britain and the United States, which, when further exploited and applied to arms production, would revolutionize war as we had hitherto known it. It was more than anything the fear of these new weapons, – and fortunately the United States had the predominance in them – which limited fresh outbreaks of hostilities to a purely local scale. And so we have been living through what is usually and not very happily called "the cold war." This has been a period, too, of great political, as well as strategic change. Partly as a result of the emancipations which war promotes, a number of great peoples in Asia, in Africa and in the Middle East achieved, for the first time or at least for the first time in decades or centuries, complete independence. In the past 10 years, 16 countries, with a total population of over 600 million, have begun to stand entirely on their own feet in the world. It was especially the leaders of these newly independent countries who feared the consequences of the strained relations between the two great groups of nations. Their concern was deepened by the emergent power of Communist China, which, while still closely allied to the Soviet Union, was asserting a policy both of independence and of expansionism. The fear of involvement in a world struggle, at a time when these new nations were trying to settle their pressing internal problems, made them, like your own country for many decades after 1776, wary of identifying themselves too closely with either one or the other of the major power groupings. At the same time, they felt strongly the need to develop their resources and raise their standards of living, while fully safeguarding their new-found independence. They are hungry for the fruits of the scientific revolution.

These fears and these longings led, earlier this year, to a new phenomenon in the political history of the world, a gathering at the city of Bandoeng in Indonesia of representatives of the Arab and African countries, of the India sub-continent, and of South East Asia. This conference may well be a milestone in the history of our time. Already there had been accumulating signs of an apparent relaxation of that Communist pressure on the free world which was the real cause of the cold war, at any rate so far as Russia was concerned. This easement was doubtless partly due to political factors like the death of Stalin, or the Kremlin's concern over Chinese expansionism. But its most important causes were probably technological: a starker realization of the implications of nuclear warfare, and economic difficulties within the Soviet empire.

Sir Roger Makins, British Ambassador to the United States, with President Killian, just before entering the Rockwell Cage where Sir Roger delivered the Commencement Address.

Now, the Conference at Bandoeng has been followed by the first traces of a thaw in the cold war in the Far East. And there is no reason, as I speak, why this process of thaw should be reversed, however gradually, however slowly, it may proceed. Bit by bit, step by step, we may hope for at least modest progress towards better relations between east and west. This in turn could lead to some measure of disarmament, some lightening of the defense burden upon our peoples, and the liberation of further resources for peaceful development. We stand, perhaps, at the beginning of a period in which our minds and wills can reach out to master the additional threats which the progress of science has imported into international relations. A balanced scheme of disarmament and the control and ultimate abolition of weapons of mass destruction are the avowed objectives of all the leading countries. There is a great reservoir, which must be emptied of mistrust and refilled with confidence, before these objectives can be achieved. But perhaps we are on our way.

(*Continued on page 522*)

Looking toward Tomorrow

By H.R.H. PRINCESS ILEANA OF ROMANIA

LADIES' BANQUET ADDRESS

THE things about the American way of life which really would give the most encouragement to the peoples behind the Iron Curtain are our full churches, the beauty of our books, and the spirit that prevails in, and leads, a place like M.I.T. Emphasis on these things, rather than as the Hollywood movies depict us – as a restless people, with an affinity for gadgets and automobiles of the latest model – would weigh in our balance with the people in captive countries. Although much publicity will be given to the new nuclear reactor to be built at M.I.T., individuals in captive countries will be happier to hear that a scientific school, such as M.I.T., has built a chapel.

One impressive and admirable quality of Americans is their desire to help other people to become a success. Europeans do not possess this quality; there is a jealousy in other countries. Americans encourage people to go forward, to become somebody, and this is one of the great secrets of American success. Americans help and admire each other, and expect people to succeed. By expecting the best, they get the best.

Romania is a good example of what happens to non-communist countries when they fall under totalitarianism. The free countries should remember that communism does not always succeed because it is in the majority or because it is the popular vote; its growth is through fear and the suppression of freedom – the kind of freedom which permitted the Alumni Day symposium talks on atoms for peace.

This text represents The Review's report, rather than a literal transcription of the address made at the Ladies' Banquet, June 13.

An informal photograph of H.R.H. Princess Ileana of Romania in the Great Court at M.I.T., immediately after the luncheon on Alumni Day.

The best allies of the Western countries are the people behind the Iron Curtain. They know and realize the value of freedom because they have lost it, and yet they cannot revolt because they have no power. The group which possesses the arms and the food has all the power, and the communists know how to acquire these. What would the United States do if they did revolt? East Germany is a sample. Everyone pretended not to notice. Yet despite the seeming indifference to their fate, at one time, as a gesture against collective farming, 5,000,000 people lost their lives in the Ukraine. They died of hunger because they refused to feed the invader!

What can we do to give these people courage? We must give much thought to the future. The question is not whether there will be a war, or a peace, but – what are we going to do after peace or war? With whom are we interested in making friends? Leaders die, governments fail, but let us remember that the people are eternal. It is the peoples' friendship we want – not those who represent them, for it is the people who are eternal; not their governments. It is the peasants who carry arms, bear children, speak the language, have allegiance to the soil – all things out of which freedom is born. That feeling of freedom is born from love of soil. People in all countries have the same dream of unity and of freedom.

How can there be peace if people have lost confidence in us? Perhaps the people in oppressed countries should think of present leaders and governments only as a bridge in a troubled time, and forget the political maneuverings which have been stopgaps.

People from all nations must get together and learn to know and to understand one another, at a time in history when there are two dominant forces: freedom and communism. The free countries must realize that nothing really penetrates behind the Iron Curtain; there is no fair exchange of ideas; the fear engendered by communism produces no leadership. The people who will not submit to totalitarianism are the danger to Moscow today, and our job is to encourage them. The communists continue to rule through fear, and therefore, we must build strong evidence to show that we are fearless. Materially, we are strong, but this strength can be increased if we develop an inner power. Our weakness is a moral one, and we are too dependent on physical and material strength. Ultimately, we must acquire a spiritual strength, and at present we do not think sufficiently in this direction.

The freedom we seek and want to share is a thing of the spirit. Because communism has power and attracts people, we must oppose it with something stronger and more vital. Let us live our lives for God, and, in the service of humanity, serve Him first. Unity in the world can be attained when we know the strength of love. Perfect love casts out fear.

Is War Inevitable?

By ARTHUR S. FLEMMING

ALUMNI BANQUET ADDRESS

As I travel about the country and speak with various groups, I find our citizens vitally interested in problems of our national defense. One of the questions I am most frequently asked is simply this: "Is war inevitable?" My answer to that question is always the same: "No! I do not believe war is inevitable!" I believe that the potential of the United States is sufficient to enable us to exercise the kind of leadership that can bring peace to the world. I believe we must have in effect what Sir Winston Churchill called "defense through deterrents" and that we must strengthen our spiritual foundations. This is not an all-inclusive list of things we must do, of course. I do feel, however, that we must achieve certain objectives in these two areas.

In a speech before the House of Commons last March Sir Winston Churchill said, in part: "There is only one sane policy for the free world in the next few years; that is what we call defense through deterrents. . . . These deterrents may at any time become parents of disarmament, provided they deter." What are some of the deterrents America must build into its defense program?

We must build and maintain a strong mobilization base. We must provide ourselves with the facilities, materials and equipment, plus the manpower, that will enable us to shift quickly into a sharply stepped-up mobilization program. We must develop supply requirements, balance and identify and close gaps. We must develop a tax amortization program designed to induce industry to put forth every effort on behalf of our national defense objectives. We must expand sources of supply and accumulate stocks of essential goods while maintaining a strong and healthy economy. Finally, we must maintain our base, giving due consideration to policies in foreign trade, to reserve programs for the armed services, and to our program of industrial dispersal.

We must devote our time, energy, and resources to the task of "keeping out in front" in the field of weapons development. We must keep ourselves in a position where we could retaliate swiftly and effectively if necessary. We must make a major investment in a system of intercontinental defense and warning systems. All of these deterrents – in which every citizen can participate – are designed to place our leaders in a position where they can deal with forces of international communism from strength.

In strengthening our spiritual foundation we recall a fundamental fact of Judao-Christian tradition in the commandment: "Thou shalt love thy neighbor as thyself." Thus we have an obligation to help our fellow human beings realize their highest possibilities. When we accept such a responsibility we give freely of our time, energy, and resources, without thought of self, to such institutions as the government, the welfare agencies of our communities and to our church. When we give of our time, energy, and resources to such institutions, we develop, as a result of our experiences, the conviction that life's greatest satisfactions come from helping others, and develop the conviction that persons live as they help others.

Out of such convictions come policies – and support for policies – that set into motion forces that can prevent war and bring peace. Such convictions produce support for President Eisenhower's program of "Atoms for Peace." We recall that this plan was presented to the United Nations Assembly in December, 1953, and that in presenting it, the President stated that it is designed to make sure that the marvelous inventiveness of man is not dedicated to his death but consecrated to his life.

War is not inevitable if we strengthen our spiritual foundations by applying to our lives the commandment "Thou shalt love thy neighbor as thyself." So it is clear that we hold in our hands the answer to the question, "Shall we have war or peace?" Each one of us can help to insure the success of the policy of "defense through deterrents." We can do this, for example, by participating wholeheartedly in our Civil Defense program. Each one of us can make a contribution to the strengthening of the world's spiritual foundations. We can do this by giving our time, energy, and resources to the church and faith of our choice. Are we going to be a part of the problem, or are we going to be a part of the answer to the problem? It has to be one way or the other; it is impossible for us to sit on the fence and be neutral.

This text represents The Review's report rather than a literal transcription of the address made at the Alumni Day Banquet.

Arthur S. Flemming, Director of Office of the Defense Mobilization, as he appeared while giving the principal address at Alumni Day Banquet.

A Benison from Friends

By JAMES R. KILLIAN, JR.

FAREWELL TO THE GRADUATES

THE great occasions and milestones of our lives, and graduation is one of these, are moments when we feel happily free to break through our normal diffidence and reticence and to voice in more personal words sentiments of felicitation, affection, and delight. On this, one of your great occasions, I would speak a concluding word to you in this spirit of unabashed sentiment. To the diploma you have won I would bestow in addition a benison and benediction from your fellows and friends in this academic community, especially those who permanently reside and work here.

I would not speak accurately if I said that our association with you had not been marked by moments of stress and discouragement. I would not be right if I assumed that your experience with the exactions of an M.I.T. education or our taut mode of living had left you with a sense of having lolled in a bed of roses or lived in a world where every prospect pleased. I think it would be accurate to say that we have learned and progressed together and that we, your senior associates, in this mutual enterprise have had the abiding satisfaction of seeing you steadily grow in grasp and reach and poise. In any great educational institution, this process of growth and achievement and leave-taking year after year never becomes commonplace or dully repetitive. It is the excitement and glory of teaching that this regenerative cycle of young people coming and going brings renewal to the spirit and new satisfactions to what otherwise could become a monotonously repetitive and unrewarding assignment.

We could not have lived and worked with you these past years without this renewing sense of partnership and fellowship. After having years of stimulating —yes, and sometimes frustrating—association with you, we could not but feel that we have a stake in your future and a vested interest in your career. And we have come to know you well enough in fair weather and foul to feel satisfaction and delight in your friendship and in your growing powers. Break through the hard-shelled, battered reserve and indifference of any one of us on the Corporation and Faculty, and you will find these latent feelings of pride, affection, and delight as you go forth. "Each of us (as Wallace Stevens phrased it) Beholds himself in you and hears his voice In yours, master and commiserable man." And so do we as we give you our benison today.

On the road ahead some of you will be successful in research or design, others ultimately in the responsible direction of great enterprises. Some of you may influence the life of our times by your qualities of leadership or by your discoveries and creative efforts or by some powerful exemplification of moral strength or purpose. Others will win their success and make their contributions not on the super-highways of life but on the quiet back roads where character and ability and simple humanity yield rich careers, unacclaimed but gracious and the very substance of our society. Statistical probability predicts that a few of you will encounter roadblocks or highway accidents and thus may not achieve marked success in the conventional sense.

Whatever may befall you on your journey, success in the deepest and truest sense will be found in the dignity and poise which you reveal in meeting both the failures and the successes of life. It will be found in your perception and acceptance of high standards and ideal aims. Your success will reside especially in your relations with people, in your capacity to be compassionate as well as steadfast, tender as well as high-minded in your loyalties and your allegiances. It was said eloquently of the Athenians that they had the gift of making "gentle the life of mankind." In our benison we include the hopeful anticipation that you will mix with your professional accomplishment some of this ingredient for making gentle the life of our turbulent times, for cultivating civility in a period of harsh and brutal incivilities.

To these unabashed and unsophisticated good wishes, I add two more arising out of the special character of this institution and your education. The first is that you serve as expositors and exemplars of the true spirit of science and the other noble disciplines whereby man seeks to understand the universe and himself. We have been living in a period marked by both subtle and gross assaults on the intellectual life. The whole domain of science has been especially subject to barbarian infiltration and to the misrepresenting propaganda that it endangers man's nobler aims and ends. In the face of the practical responsibilities which rest in science for our security and our material welfare, it is all too easy for people to become bemused by the sophistry that science is inimical to the spiritual ends of life, and for them to fail to understand that instead, it is one of man's most powerful and noble means for searching out the truth and augmenting man's dignity by augmenting his understanding. You and we have an obligation to make this true character of science better understood, and to do so, not by the arrogant advocacy of science and technology as the only means to increase our understanding and well-being, but by the balanced and tolerant presentation of the scientific spirit as one of the great and powerful methods by which man can increase his knowledge and understanding and still stand humble and ennobled before the wonder and the majesty of what

(*Concluded on page* 534)

"And Departing, Leave Behind Us"—

Compton Memorial Fund Reaches One Million Dollars, Alumni Discuss Peaceful Uses of Atomic Energy, and M.I.T. Awards Nearly 1,000 Degrees at Commencement

THE program of Alumni Day, June 13, and of the Commencement exercises of June 10 — which concluded the Senior Week social whirl — were the most significant events in bringing another year of activity at M.I.T. to a successful close.

Since the Class of 1954 left Cambridge, the Institute has witnessed great sadness in the loss of a former president — Karl Taylor Compton — and several other members of the Corporation and Faculty. But the year has also brought satisfaction and progress, especially in the completion of the new Kresge Auditorium and Chapel, as reported in full in the June issue of The Technology Review. As members of the graduating class departed, they left behind them a new tradition — that of using to the fullest, for their intended purposes, these new additions to the Institute's physical plant — for a number of year-end class events were staged for the first time in the auditorium or chapel.

Continuing the practice re-established last year, Alumni Day 1955 opened with a morning conference on "Uses and Economics of the Peaceful Atom" held in the Kresge Auditorium. Distinguished leaders in the field of atomic energy took leading roles in this conference which was open to all Technology Alumni who wished to return to M.I.T. for the occasion. But a special effort was made this year to invite non-Alumni leaders in business, education, and industry as Technology graduates faced the problems of adapting our way of life to new conditions which the atomic age inevitably presents.

Two other innovations of Alumni Day are worthy of recording at this point. Advance copies of the new, tenth edition of the "Register of Former Students" made their appearance on June 13, and by the time this issue reaches Review readers, advance orders for this reference work will have been filled. The second innovation of Alumni Day 1955 was a change in the banquet from the usual "Stein-on-the-Table" affairs of former years, with souvenir steins as pleasant rememberance of a happy event. This year those who attended the Alumni Day banquet took home, as souvenir, one of the Wedgwood dinner plates designed by Samuel Chamberlain, '18, and showing scenes around the Institute.

Senior Week Events

More than a week of social events for members of the graduating Class began on June 1 with the Senior Banquet in Rockwell Cage. The Class Party and Carnival was held at Walker Memorial the evening of Saturday, June 4, and the following evening, June 5, the Class of 1955 attended the Boston "Pops" Orchestra Concert, at Symphony Hall. The Seniors took a cruise from Rowes Wharf to Nantasket on Monday, June 6, and held their annual Senior Ball at the Sheraton Plaza Hotel on Tuesday, June 7. No activities were scheduled for June 8.

On Thursday, June 9, members of the graduating class marched to the Kresge Auditorium at 10:30 A.M. for joint Army and Air Force commissioning exercises of the Reserve Officers Training Corps. At 1:15 P.M. they returned to the Kresge Auditorium for the class picture and attended the Baccalaureate service at 3 P.M. at which the Baccalaureate address was given by Frederick May Eliot.

Two married couples were among those who received degrees at this year's commencement exercises. (left) Cora Sleighter Stackelberg received a S.B. degree in electrical engineering while Olaf Patrick Stackelberg received the S.B. degree in mathematics. (Center) John D. C. Little, '48, and Elizabeth Alden Little, both receive the Ph.D. degree in physics. (Right) Officers of the Class of 1955 are (left to right): Walter Chandler Stevens, President; John Joseph Seiler, Vice-president; Miss Dell Fleetwood Lanier, Secretary-Treasurer; and Lavan Dennis Shapiro, Assistant Secretary-Treasurer.

Honored guests at the Commencement Day luncheon included (left to right): Godfrey L. Cabot, '81, William Barker, British Consul General, Mrs. Frank J. Chesterman, Hugh S. Ferguson '23, President of the Alumni Association, Mrs. Erwin H. Schell, Walter C. Stevens, President, Class of 1955, Mrs. James R. Killian, Jr., Sir Roger Makins, British Ambassador to the United States who gave the Commencement Address and President James R. Killian, Jr., '26.

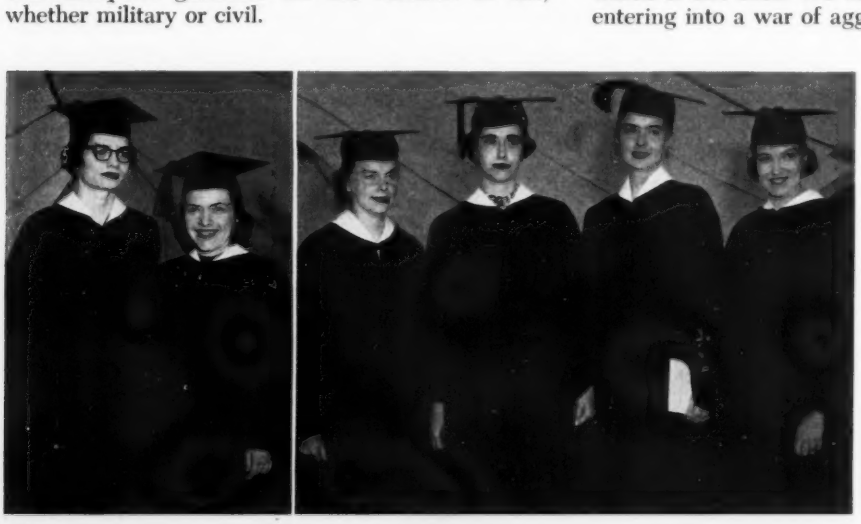
Commissioning Exercises

The commissioning exercises of the United States Army and the United States Air Force were held as a part of commencement exercises this year. Vice-admiral Edward L. Cochrane, '20, represented M.I.T. in his role as Vice-president of the Institute. With a Navy man in such a post all three services may be said to have taken part in the exercises which were opened with the General's March played by the Needham High School Band. The invocation was given by the Reverend Peter B. Blynn, of the Church of the Advent in Boston. Brigadier General Einer B. Gjelsteen, Commanding General of Fort Devens, Mass., and Brigadier General Kurt M. Landon, Deputy Commander, Air Research and Development Command, Baltimore, presented commissions for the Army and Air Force, respectively.

In introducing the two Generals who made the presentation of commissions Vice-president Cochrane commented on the value of mottoes as a guide to a way of life. Mottoes, he said, were used more frequently in the past than now, but there is merit in paying attention to them, especially on occasions such as those of commencement and commissioning exercises. He reminded the audience that the M.I.T. motto, "Mens et Manus" stood for "Hand and Mind"; that the motto of the Naval Academy was "Out of Knowledge Comes Sea Power," and that the Military Academy had adopted the motto "Duty, Honor, Country." Taken together, these three mottoes provide adequate guidance for the conduct of life, whether military or civil.

General Gjelsteen commented on the vast changes that have taken place in military affairs. Even President Eisenhower had commented on the changes that had taken place in the four decades since he graduated from West Point. But in the midst of change of vast proportions, the need for leaders remains fixed and constant. Leaders must be trained now, while there is time for such training; we cannot wait until we need them. General Gjelsteen reminded the audience that, for the United States, every war is a "reservists" war; we cannot conduct military operations solely by use of professional soldiers. The Reserve Officers Training Corps is the backbone of the officers corps. The future task of those graduating from the Institute and receiving commissions will be the application of science and engineering to military applications and needs. The R.O.T.C. program, said General Gjelsteen "is our way of stockpiling officers, leaders, and engineers." Such stockpiling does not become out of date or obsolete, but increases in value with the years.

General Landon also commented on the need of well trained leaders as a matter of national defense. Step by step, and at an ever increasing rate, the methods of warfare are ever increasing. Today modern warfare is so devastating that it is doubtful if either the victor or the vanquished could enjoy the fruits of combat for at least many years after conflict. This, in itself, is a deterrent to war. Certainly this nation has nothing to gain by conducting war. We covet no nation, no people, no part of the world which is not ours. We have everything to lose by entering into a war of aggression. We are interested



Among almost a dozen members of the distaff side who received degrees this June were (left to right): Ella Margreta Paton, Franceline Ann Cullen, Mrs. Cora Sleighter Stackelberg, Marolyn Coffin Kimball, Marilyn Fraser, and Joyce Patricia Davis. The relatively large number of women graduates, in what has commonly been considered to be a school for men, continues to lend emphasis to the co-educational nature of the courses of instruction at the Institute.

Other guests at the Commencement Day luncheon were (left to right): President Killian, Mrs. William Barker, Frank J. Chesterman, '05, Eldon Reiley, '55, Mrs. George A. Znamensky, Erwin H. Schell, '12, who becomes Professor Emeritus, Mrs. Hugh S. Ferguson, and Ralph C. Young '29 of the Department of Chemistry, and George A. Znamensky, of the Department of Modern Languages, both of whom retired this June.

only in our own defense. In such a situation we cannot rely on mere quantitative superiority especially that achieved through technical achievement and talent. It is with this thought that the new officers take their commissions. Then, turning to the newly commissioned lieutenants, General Landon told them their horizons for service are unlimited.

Colonel Glenn C. Coleman, Professor of Air Science, administered the oath of office to 61 graduates in the Air Force and 111 in the Army. A few of the graduates will receive their commissions upon completion of summer training; but most pinned on their bars as officers at the end of these exercises.

Following the presentation of commissions, the Needham High School Band – which has taken part in commissioning exercises for the past several years with consistently commendable performance – played the National Anthem, and the exercises were concluded with the benediction given by Rabbi Herman Pollack, adviser to the M.I.T. Hillel Society.

The Baccalaureate

The Baccalaureate for the Class of 1955 was held at 3 P.M. in the Kresge Auditorium on Thursday, June 9. Since the organ for the new auditorium has not yet been installed, Melville Smith used the organ in the Chapel for a program transmitted by wire to the Auditorium. Organ prelude included "Pastoral in Four Movements" by Johann Sebastian Bach, variations on "Mein Junges Leben" by Jan Pieters Sweelinck, and organ prelude on the Welsh tune, "Rhosymedre" by Ralph Vaughan Williams. Graduates entered and took their seats to the "Processional" by Frank Bridge, and "March in C" by Nicholas le Begue. The invocation was given by the Reverend J. Edward Nugent, Chaplain of the Technology Catholic Club; the M.I.T. Brass Choir rendered "Paduana" by Benedictus Grep, and Rabbi Herman Pollack gave the Meditation.

Frederick May Eliot, President of the American Unitarian Association gave the Baccalaureate address, "Freedom is a Noble Thing." The theme of this address – which the Review brings to its readers on page 479 – is taken from the apostrophe to freedom in "The Brus," by John Barbour, and was expressed in Aaron's Copland's "Canticle of Freedom" at the dedication exercises of the Kresge Auditorium

The Reverend John Crocker, Jr., Episcopal Chaplain to M.I.T. students, gave the benediction, and Melville Smith concluded the exercises with the postlude "To God on High Alone Be Praised" by Johann Sebastian Bach.

Although not taking speaking parts in the exercises, President Killian, Provost Stratton, and Heads of Departments were in attendance and on the podium as shown in the illustration on page 479.

Commencement Exercises

Approximately 4,500 relatives and friends of those taking part in commencement exercises gathered at Rockwell Cage on Friday, June 10, to witness 927 students receive a total of 967 degrees as of this June. Several dozen more who took part in the exercises received their degrees as of last September or last February.

After more than a full week of cold, damp, uninviting New England weather, June 10 dawned bright and fair, and the day was perfect for the occasion.

Graduates and those taking part in the academic procession gathered about 10 A.M. in the Massachusetts National Guard Armory, adjacent to the Rockwell Cage, for robing. Promptly at 10:30, as Melville Smith, playing at the organ at the new Kresge Chapel, played marches suitable for the occasion, the academic procession of graduates, the Faculty, members of the Class of 1905, representatives of the Class of 1940, the M.I.T. Corporation, and guests of honor entered the Rockwell Cage and took their seats.

As President of the Alumni Association for the year 1954 – 1955, Hugh Ferguson, '23, opened the exer-

Facing the camera as they welcome guests in the reception line after Commencement Day luncheon were President Killian, Mrs. Killian, Julius A. Stratton, '23, Vice-president, Mrs. Stratton, and (partly hidden by lady in straw hat) Walter C. Stevens, President of Class of 1955.

Seated at the head table at the Alumni Day luncheon are (left to right): H. E. Lobdell, '17, Mrs. Allen W. Burke, Mrs. Fred W. Goldthwait, Dr. Shields Warren, symposium speaker, Mrs. Edward L. Cochrane, Godfrey L. Cabot, '81, Mrs. Hugh S. Ferguson, John von Neumann, symposium speaker, Mrs. Richard S. Morse, and President Killian.

cises, and the invocation was given by the Reverend George Arthur Buttrick, Preacher to the University, Harvard University. President Killian then introduced the Right Honourable Sir Roger Makins, British Ambasador to the United States, who gave the principal address on this important occasion. Sir Roger's stimulating address pointed out the need for science and technology to be used constructively in fostering international relations, and urged the graduates to use their technical training, supplemented by knowledge of history and international relations, to promote world peace. The Commencement Address is one which every graduate will wish to reconsider after the excitement of the occasion is past, and The Review is pleased to publish Sir Roger's address (page 480) as part of its report of this Commencement.

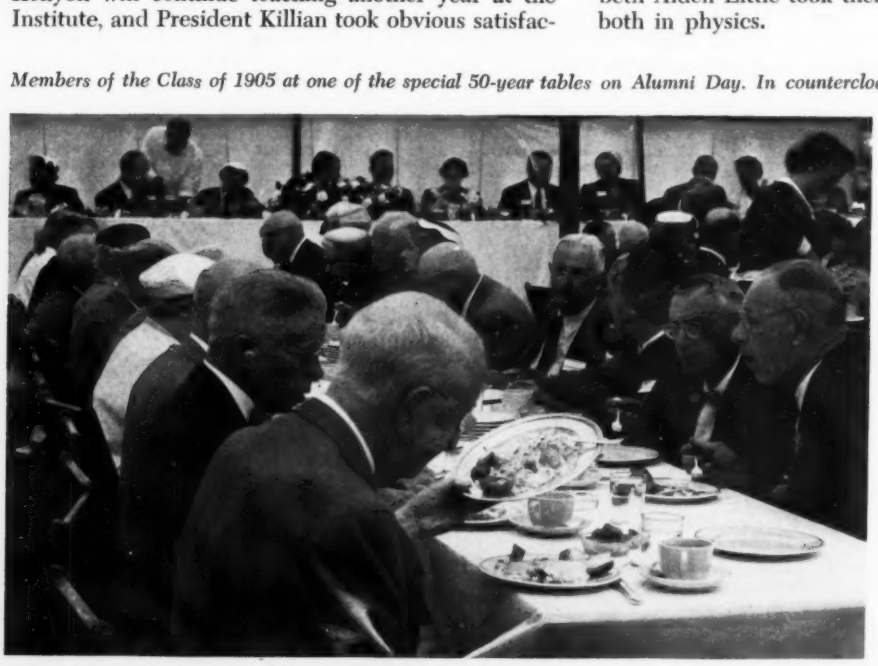
President Killian, assisted by George R. Harrison, Dean of the School of Science, then made the presentation of the Goodwin Medal, to James Kenyon Knowles, teaching assistant in the Department of Mathematics. The Medal, named after the late Harry Manley Goodwin, first dean of the M.I.T. Graduate School and an outstanding and beloved teacher, is awarded to a graduate student member of the academic staff for conspicuously effective teaching. Mr. Kenyon will continue teaching another year at the Institute, and President Killian took obvious satisfaction in awarding the Goodwin Medal, a certificate, and a check, to Mr. Kenyon, who had been voted by Technology Students most deserving of this award. Freddie David Ezekiel, and Francois Lamy received Honorable Mention for excellence in teaching.

The Deans of the Institute's six professional schools, together with Julius A. Stratton, Vice-president and Provost, and Robert M. Kimball, Secretary of the Institute, awarded the diplomas to the graduates, and invested hoods to those receiving the doctorate degrees.

President Killian gave the Charge to the graduates, which The Review is happy to publish on page 484 of this issue. The ceremonies were concluded with the academic recession of the assembly and organ postlude.

The Class of 1955 was somewhat unusual in having four, rather than three Class Officers, one of whom was a young lady. It was unusual too, in that nine members of the distaff side received bachelor's degrees, and one received a master of science degree, and one received a Ph.D. degree (as of September 1954). Among those receiving degrees were two married couples: Olaf Patrick Stackelberg and Cora Sleighter Stackelberg received bachelors degrees together, and John Dutton Conant Little and Elizabeth Alden Little took their Ph.D. degrees together, both in physics.

Members of the Class of 1905 at one of the special 50-year tables on Alumni Day. In counterclockwise order, are: Willard C. Tilson, Daniel P. Pousland, Herman T. Gammons, George M. Bartlett, Mrs. Andrew Fisher, Andrew Fisher, Courtlandt W. Babcock, Mrs. C. W. Babcock, Henry P. Charlesworth, Leonard W. Cronkhite, Charles A. Emerson, William L. Spalding, Grove D. Marcy, and Herbert W. Kenway, Class President. Facing camera, far side of table, left to right are: Mrs. James E. Barlow, James E. Barlow, Mrs. Waldso Turner, Waldso Turner, Mrs. Roy H. Allen, Roy H. Allen, Mrs. Frank J. Chesterman, Frank J. Chesterman, Robert W. McLean, Willis F. Harrington, Mrs. Ralph E. Hadley, Ralph E. Hadley, and Gilbert S. Tower.



Guests at the head table on Alumni Day also included (in reading order): President Killian, Richard S. Morse, '33, Luncheon Chairman, Mrs. James R. Killian, Jr., T. Keith Glennan, symposium speaker, Mrs. Shields Warren, Hugh S. Ferguson, '23, Mrs. H. E. Lobdell, E. L. Cochrane, '20, H.R.H. Princess Ileana of Romania, Alan W. Burke, '20, and Fred W. Goldthwait, '05.

Commencement Luncheon

Upon conclusion of the Commencement Exercises, graduates, their families, members of the Faculty, and members of the 50-Year Class, assembled in the Du Pont Court, under canvas, for an informal Commencement Luncheon. The Great Court was the occasion for much camera clicking as proud graduates, in cap and gown, posed with parents, friends and relatives in the bright sunshine, in most cases with the large M.I.T. dome as background.

When nearly everyone had finished the buffet-type luncheon, President Killian opened the informal part of the program in which members of the Faculty, and representatives of the Classes of 1905 and 1955 had opportunity to speak.

President Killian reminded the audience that this luncheon was planned to be informal, and that different groups, as noted above, were represented at the head table; the gathering of representatives of the Class of 1905 as well as the Class of 1955 was taken to symbolize the perpetual youth with which a university is surrounded. President Killian quoted a statement by Sir Winston Churchill which emphasized the perpetual youth of university life, and which emphasized that a university looks to the future rather than to the past. Technology, said Dr. Killian, expressed its perpetual youth by inviting members of the 50-year Class to the luncheon, but there are other ways of demonstrating perpetual youth. Godfrey Cabot, member of the Corporation and Alumnus of the Class of 1881, was present at the head table. He was born six days before Lincoln was inaugurated for his first term as President of the United States.

Speaking of the youthfulness of the Class of 1905, President Killian outlined certain characteristics of this Class. It was this Class who opposed the merger with Harvard at a time when M.I.T. finances were in a precarious condition. Since 1905 the reputation of M.I.T. has not changed, and the members of the Class of 1905 have done much to maintain Technology's reputation. Singled out for mention were a number of members of the Class of 1905 who had made contributions of note since they graduated from Technology half a century back.

President Killian then called on a prominent member of this distinguished Class to speak on behalf of the Class of 1905 – Frank J. Chesterman. Speaking for his classmates, Mr. Chesterman recalled that there were about 600 members in the graduating Class of 1905, and that the Institute of half a century ago had considerably fewer advantages and facilities than it now has. There was, he said, virtually no undergraduate life; most of the students lived at home and commuted to the Institute. There was little contact with members of the Faculty, and Faculty-student counselling such as now exists was unknown.

Mr. Chesterman expressed pride that the Institute did not merge with Harvard in the tempting days when its finances were meager while Harvard had the McKay bequest for a school of engineering. Mr.

Present on left side of table, near to far were: Jack H. Flynn, '05, Mrs. A. Vaughan Gregory, Gilman B. Joslin, '05, George Fuller, '05, Willard E. Simpson, '05, Mrs. John Ayer, John Ayer, '05, Mrs. Jack Flynn, Mrs. Charles Smart, Charles Smart, '05, Henry J. Stevenson, Mrs. Isadore Nye, Isadore Nye, '05, and John A. Nolan, '03. At the right side of table, far to near, are: Mrs. Benjamin E. Lindsley, Benjamin E. Lindsley, Mrs. Myron E. Helpern, Myron E. Helpern, '05, Mrs. Eugen F. Kriegsman, Eugen F. Kriegsman, '05, Eliza Newkirk Rogers, '05, T. Herbert Files, '05, Mrs. T. Herbert Files, Miss Alice E. Buff, Henry A. Buff, '05, Arthur T. Balkam, '05, Chester R. Shaw, '05, and Fred P. Poole, '05.

Those at the head table of the Alumni Day Banquet are (left to right): Dwight C. Arnold, '27, president elect, Alumni Association; Joseph J. Snyder, 2-44, M.I.T. Treasurer, and Vice-president; Theodore T. Miller, '22, Chairman, Alumni Fund Committee; Edward L. Cochrane, '20, Vice-president; Arthur Flemming, banquet speaker; President Killian; Hugh S. Ferguson, '23, President, Alumni Association; T. Keith Glennan, symposium speaker; Julius A. Stratton, '23, Vice-president; Shields Warren, symposium speaker; Robert W. McLean, '05, who presented the 50-year class gift; John J. Rowlands, Head of M.I.T. News Service and newly-elected Honorary Member of the Alumni Association; John F. Bennett, '30, who presented the 25-year class gift; and Donald W. Kitchin, '19.

While Alumni had their banquet in the ballroom of the Hotel Statler, the ladies had their own banquet in adjoining parlors. Cut at left shows honored guests at the left half of the head table, (left to right) as follows: Mrs. Joseph J. Snyder, Mrs. Donald W. Kitchin, Mrs. Avery H. Stanton, Mrs. James R. Killian, Jr., and H.R.H. Princess Ileana of Romania.

Honored too, were, (below, left to right): Mrs. Julius A. Stratton, Mrs. H. E. Lobdell, Mrs. Edward L. Cochrane, Mrs. Hugh S. Ferguson, Mrs. Theodore T. Miller, and Mrs. Gilbert M. Roddy.

Chesterman also recalled another event in which Tech and Harvard were principals — a torchlit parade on the eve of a national election. The Harvard men paraded with cap and gown, whereas students from M.I.T., in utter disregard for such trappings, came out in overalls.

Mr. Chesterman stated that he felt his Class had missed some of the humanities which today's students can benefit by. In this respect, Harvard of 50 years ago had something that Technology lacked.

One of the greatest things that the Institute has done in recent years, Mr. Chesterman felt, was to establish the School of Humanities. Today's students have opportunity to flavor their technical studies with studies in the humanities and thereby to round out their development. Today's graduates have great responsibilities because of their training and capabilities. There is great need for well-trained persons having high devotion to public service, and he pledged support to M.I.T. from his own Class and urged such support from the Class of 1955.

President Killian then called upon Walter C. Stevens, permanent president of the Class of 1955. Mr. Stevens welcomed the parents and guests, paid tribute to the Class of 1905, and modestly stated that

Celebrating are the following men at the Alumni Day Banquet (left to right): William Binley, '97, Walter Humphreys, '97, Jere R. Daniell, '97, George R. Wadleigh, '97, Samuel T. Smetters, '96, Paul W. Litchfield, '96, and James M. Driscoll, '96.

Alumni of the "Elder Statemen" group at the banquet on June 13 included (left to right): Leonard B. Buchanan, '93, Norwin S. Bean, '94, Spaulding Bartlett, '90, George A. Packard, '90, Chester V. Carlton, '90, John L. Damon, '91, Harry H. Young, '91, and Samuel P. Hunt, '91.

the achievements of the Class of 1955 were largely due to the Executive Committee which was responsible for student government. Mr. Stevens then introduced the six members of this committee, and asked them to rise.

Eldon Reiley, '55, was then called upon by President Killian to speak on student government. Mr. Reiley thought it would be nice to be able to predict for his Class accomplishments such as those achieved by the Class of 1905. But, he said, science fiction writers seem to fear the future. Mr. Reiley felt his Class was not headed for a gloomy future, although he admitted that now that commencement was upon him, many members of the Class had an empty feeling in the knowledge they would leave Technology. They came to like the old place more and more as their studies continued. One of the principal reasons, he thought, was the fact that M.I.T. is alive – alive to the world around it. It is leading and making the changes we see in life, not merely following these changes. The Institute is vital; its vitality can be seen in the changes that have occurred in the past four years. It can be seen in the buildings, in the new courses, and new athletic and recreational facilities. What college, Mr. Reiley asked, would have the courage to build an auditorium in spherical shape, or a chapel in cylindrical shape? What college could boast of a Dean who – it is reputed – was ring-leader in a "panty-raid?" In conclusion he expressed thanks to members of the Faculty, to parents, and to his classmates.

President Killian then spoke of the coming and going of members of the Faculty. He announced that three members of the Faculty would retire this year, and introduced Professors George A. Znemansky and Ralph C. Young, '29, and gave brief biographies of them. He also spoke of the retirement of Professor Erwin H. Schell, '12, who had been one of Dr. Killian's most admired teachers, and asked Professor Schell to speak on behalf of the retiring Faculty members, which he did with typical verve.

Following the luncheon, President and Mrs. Killian, Provost and Mrs. Stratton, and Walter C. Stevens, '55, and Eldon Reiley, '55, greeted graduates and their relatives and friends in a reception line in the Great Court, adjacent to the tents in Du Pont Court where the luncheon had been held.

Among those who celebrated their 25th anniversary reunion on June 13 were (above, left to right): William H. Buracker, Benjamin C. Buerk, Harvey W. Chapman, Irwin E. Ross, Jr., Morell Marean, Allen Latham, Jr., George F. Theriault, (pretty well hidden), Myron T. Smith, Hermon H. Scott, and Emmanuel L. Pavlo, all of the Class of 1930.

Another table of members of the Class of 1930 included (below, in usual order): Joseph Harrington, Jr., George P. Wadsworth, Richard M. Wilson, Parker H. Starratt, Robert D. McCarron, Gordon K. Lister, Ralph W. Peters, Stanley C. Wells, Henrietta J. Dane, and Donald W. Diefendorf.

Class of 1930 Reunion at M.I.T.

Following a precedent established three years ago, the Class of 1930 held its 25th year reunion at the Institute where Baker House was the center of activities. On Friday, June 10, a social hour was held in the afternoon and a buffet-type supper dance in the evening.

On Saturday, rainy New England weather returned for two days, but it did not dampen the spirits of the reunioning classmates. Guided tours of the Institute, including opportunity to visit the Kresge Auditorium and Chapel, were scheduled for Saturday morning. Walker Memorial was the scene of the Faculty reception and luncheon, and in the afternoon a social hour was held at Baker House. In the evening, while Alumni held their class banquet at the Parker House Hotel, the ladies had dinner at the Sherry-Biltmore Hotel and attended the "Pops" Concert at Symphony Hall in Boston.

Despite rainy weather, reunioning classmates and their families attended church on Sunday morning and then made a bus tour of the North Shore. By 2:30 P.M. they were enjoying a shore dinner at the estate of Mr. and Mrs. Morrell Marean in Marblehead Neck where 75 persons could be served at once on an outdoor porch. Last scheduled event of the quarter century reunion was a buffet supper at Baker House back at the Institute.

Alumni Day Symposium

Excellent weather returned to Boston for Alumni Day, when the Registration Desk in the lobby of the Rogers Building opened for early arrivals at 8 A.M. A few advance hand-bound copies of the 1955 edition of the *Alumni Register* which were displayed, drew favorable comment.

A conference on "Uses and Economics of the Peaceful Atom" was held in the Kresge Auditorium at 10:00 A.M. with Vice-admiral Edward L. Cochrane, '20, M.I.T. Vice-president, presiding over a panel of distinguished speakers. Those taking part in the symposium were John von Neumann, Commissioner of the Atomic Energy Commission, who spoke on "Impact of Atomic Energy on the Physical and Chemical Sciences;" Dr. Shields Warren, Professor of Pathology at the New England Deaconess Hospital, who spoke on "Impact of Atomic Energy on the Life Sciences," and T. Keith Glennan, President of Case Institute of Technology, who spoke on "Impact of Atomic Energy on our Economy and Way of Life."

Admiral Cochrane welcomed the conference speakers and the guests on behalf of President Killian, and pointed out that the conference on Alumni Day, 1954, entitled "The Next Ten Years" was an experiment in organizing a general symposium on important topics of the day. But we are now concerned with harnessing atomic energy for peaceful uses and the great research activity in the field of atomic energy makes it necessary to look again at progress in this area.

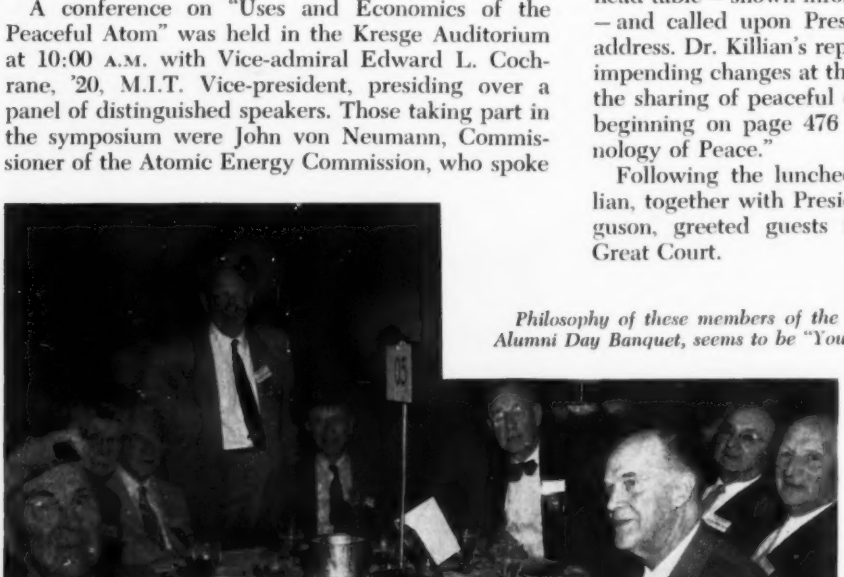
Vice-president Cochrane reminded his audience that the harnessing of atomic energy for peaceful activities is not new in this country, but that the urgency of military needs of such energy, coupled with limitations of the Atomic Energy Act of 1947 hampered industrial participation.

It is The Review's privilege and pleasure to be able to make a comprehensive report on these conference addresses. The text of the addresses by Dr. Shields Warren and President T. Keith Glennan appear, respectively, on pages 471 and 473 of this issue. As this issue goes to press it appears that text of Dr. von Neumann's address may be made available when The Review resumes publication in the fall.

Alumni Day Luncheon

As master of ceremonies for the Alumni Day luncheon, Richard S. Morse, '33, introduced those at the head table – shown informally on pages 488 and 489 – and called upon President Killian for the major address. Dr. Killian's report to Alumni on recent and impending changes at the Institute, and emphasizing the sharing of peaceful objectives, is given in detail beginning on page 476 under the title "The Technology of Peace."

Following the luncheon, President and Mrs. Killian, together with President and Mrs. Hugh S. Ferguson, greeted guests in a reception line in the Great Court.



Philosophy of these members of the Class of 1905 who attended the Alumni Day Banquet, seems to be "You're only as old as you feel!" Left to right are: Harry P. Charlesworth, George Fuller (in Davy Crockett coonskin caps), Eugen Kriegsman, '05, Fred W. Goldthwait, (standing, with coonskin cap), Gilman B. Joslin (another Davy Crockett devotee), Gilbert S. Tower, Myron P. Helpern, Isadore Nye, and Courtlandt W. Babcock.

Theodore T. Miller, '22, Chairman of the Alumni Fund Committee derives much pleasure in announcing that the Fund has reached the all-time record of half a million dollars. In addition, this sum is equalled by an anonymous friend of the Institute, thereby raising this year's Alumni Fund to one million dollars as tribute to Karl Taylor Compton in whose memory the Fund was raised.

Afternoon Activities

After the guests moved through the reception line in the Great Court, they were free to spend the afternoon in whatever way best suited their fancy. Most of those who returned to Technology for reunions, preferred to chat with classmates and other friends. But they could attend the chapel where, from 2:30 to 3:00 and again from 4:00 to 4:30 P.M., Philip M. Richardson, '26, gave a recital of organ music on the new chapel organ designed and built for the Institute by Walter Holtcamp of Cleveland. Or, they might have visited the new auditorium where, between 3:00 and 5:00 P.M. there was a continuous showing of two recent films about the Institute's current educational and research work.

Between 5:00 and 6:45 P.M. a social period was held at the Georgian Room in the Hotel Statler, preceding the banquet. Here several hundred Alumni and their ladies gathered for pre-banquet festivities. In addition, several classes held their own pre-dinner gatherings at various places in the Hotel Statler.

Ladies Banquet

At 7:00 P.M. 160 ladies attended their own banquet in Parlors A, B, and C of the Hotel Statler while Alumni had their banquet in the Ballroom. Mrs. Julius A. Stratton presided, introduced those at the head table, and paid tribute to Miss Julia A. Comstock and Mrs. James R. Jack, both ladies of whom have given long service to Technology. Mrs. Stratton also introduced the guest of honor, H.R.H. Princess Ileana of Romania, whose son was a member of the Class of 1955, and who gave a scintillating address, "Looking Toward Tomorrow" which The Review reports on page 482.

Alumni Banquet

Promptly at 7:00 the doors of the Ballroom of the Hotel Statler were opened for the 700 Alumni, who took seats at class tables while Harry U. Camp, '18, at the organ, played a group of Technology songs as background music. As usual, O. B. Denison, '11, led the singing of "Arise Ye Sons of M.I.T." and also of the National Anthem.

As retiring president of the Alumni Association, Hugh S. Ferguson, '23, introduced the guests at the head table, and called on Alumni who travelled from the greatest distances to take a bow.

On behalf of the M.I.T. Alumni Association, President Ferguson then awarded a certificate of Honorary Membership in the Alumni Association to John J. Rowlands, since 1926 Director of the M.I.T. News Service and for almost the same length of time an editorial associate of The Technology Review. By a vote of the Executive Committee, honorary membership may be conferred upon "any present or former member of the Corporation or any person or former officer of administration of instruction on the staff of the Institute or anyone who has rendered outstanding service to the Association or the Institute." Mr. Rowlands was cited particularly for his long, faithful, and self-effacing service in administering the Institute's news and public relations program for more

(*Continued on page 504*)

President Killian shakes hands with John F. Bennett (below), who has just presented the gift of the Class of 1930.

As Hugh S. Ferguson, '23, looks on (above), President Killian accepts the gift of the Class of 1905 from Robert W. McLean.

THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

Business Session

THE 311th meeting of the Alumni Council – the last one of the current school year – was held at the M.I.T. Faculty Club on the evening of Monday, May 23. Hugh S. Ferguson, '23, President of the Alumni Association, presided over the 113 members and guests who were present. Although considerably shortened in presentation from what was common in earlier years, reports on alumni affairs took up the business portion of the meeting.

As Treasurer, Donald P. Severance, '38, reported that the Audit and Budget Committee had endorsed the proposed budget of about $67,000 for 1955–1956 which was approved by the Executive Committee. Also reported was that the Executive Committee had elected the following officers for 1955–1956: H. E. Lobdell, '17, Executive Vice-president; Mr. Severance, Secretary and Treasurer; Henry B. Kane, '24, Director of the Alumni Fund; and Miss Madeline R. McCormick, Assistant Treasurer.

Officers of the Alumni Association were announced, as recorded on page 407 of the June issue of The Review. Theodore T. Miller, '22, will serve a second year as Chairman of the Alumni Fund Board, and Whitworth Ferguson, '22, will serve on this board for a five year term beginning June 30, 1955.

As Executive Vice-president of the Alumni Association, Mr. Lobdell presented his annual report which emphasized work, which was nearing completion, on the 1955 edition of the *Register of Former Students*. It was announced that an anticipated deficit of $2,350 for the year's operation of the Alumni Association would again be made up by excess of income over expenses for Volume 57 of The Technology Review, and that a new M.I.T. Club was established in Madrid during the past year. As Alumni Fund Director, Mr. Kane reported that 10,350 Alumni had contributed $446,180 to the Alumni Fund for the current year, an amount $212,000 more than last year's final figure. Also reported was the fact that 90 per cent of the Council members had contributed to the Fund to be used for the Compton Laboratories.

Introduced by John E. Burchard, '23, Dean of the School of Humanities and Social Sciences, John M. Blum, Associate Professor of History, described the new Course XXI. Dr. Blum outlined the new course as a program aimed to integrate humanities with science and engineering. Dr. Blum believes that this new course can provide, for a certain type of interested young man, a greater capacity to cope with the everyday complex problems of the engineer; and that it might serve as a preparation for young men going into public administration, law, medicine, and possibly even the liberal arts.

Edward G. Sherbourne, Jr., '41, Director of Programs for WGBH FM-TV, the radio stations of the Lowell Institute Co-operative Broadcasting Council, spoke on the growth and methods of operation of educational television stations in the United States. He emphasized the operation of WGBH-TV which initiated educational television broadcasting programs in the Boston area on May 2. This station operates on Channel 2 for three and one-half hours per day, five days per week. Unlike most educational television stations, WGBH is operated by a combination of educational institutions and cultural organizations which support the station and its visual programs. John E. Arnold, '40, Associate Professor of Mechanical Engineering, has been named the Institute's television co-ordinator for WGBH, and Robert Gilmoré is the Institute's full-time producer-director.

Lowell School Graduates 153

ARTHUR L. Townsend, '13, Director of the Lowell Institute School, officiated at the 51st graduation exercises of this unusual educational institution on Thursday, May 26. The exercises were held at 8:30 P.M. in Huntington Hall at the Institute.

Gordon S. Brown, '31, Head of the M.I.T. Department of Electrical Engineering, brought official greetings from M.I.T. to the graduates, and William G. Sutcliffe, Dean of the College of Business Administration at Boston University, gave the Commencement Address. Ralph Lowell, Trustee of the Lowell Institute School and member of the M.I.T. Corporation awarded the certificates and diplomas to the 80 students who completed advanced or supplementary courses. Dr. Lowell and Professor Townsend shook hands with each student as he received his red-bound certificate.

As in recent years, another feature of the exercises was the tenth presentation of the Charles Francis Park Medal, awarded annually to recognize the outstanding member of the graduating class. The medal is named in honor of the first director of the Lowell Institute School and a former Technology professor. This year the medal was awarded to Juan Hamilton Crawford. After having served in the army and a year or two in industry in his native Buenos Aires, Mr. Crawford came to the United States for the express purpose of availing himself of the unusual opportunities which the Lowell Institute School afforded. His interested in the School was aroused by an article on the Lowell School a few years ago in the overseas edition of the *Christian Science Monitor*. Mr. Crawford requested his company to transfer him to its Boston office, and worked for his passage to this country in order to attend evening classes during the past three years as a student in the mechanical course.

Faculty Appointments

FOUR appointments to senior posts on the Faculty of the Massachusetts Institute of Technology were announced late in May by Julius A. Stratton, '23, Vice-president and Provost of the Institute.

Houlder Hudgins, Vice-president of Galen Van Meter, Inc., Financial Management Consultants, will become Professor of Industrial Management in the School of Industrial Management.

Knox Millsaps, chief of the Applied Mathematics Research Branch at the Wright Air Development Center, Wright Patterson Air Force Base, Dayton, Ohio, will be visiting professor in the Department of Mechanical Engineering for the 1955 – 1956 academic year.

Effective July 1, James A. Fay, '47, assistant professor in the Department of Engineering Mechanics at Cornell University, will be associate professor in the M.I.T. Department of Mechanical Engineering.

Professor Howard W. Johnson of the School of Business at the University of Chicago, will become associate professor in M.I.T.'s School of Industrial Management beginning in July.

Born in Brooklyn, New York, on May 22, 1900, Mr. Hudgins has had extensive business and industrial experience. He prepared for college at the Horace Mann School in New York, and was graduated from Cornell University with the degree of Bachelor of Arts in 1923. From that year until 1927 he was instructor of Industrial Management and Accounting in the School of Engineering at Cornell University. From 1928 to 1932 he was assistant to the treasurer and successively controller, assistant general manager, and merchandise manager of Mandel Brothers, a department store in Chicago. For five years beginning in 1933, he was manager of the Furniture and Home Furnishings Division of Montgomery Ward and Company. He left this firm to become president of Sloane-Blabon Corporation, manufacturers of linoleum in New York. Subsequently he became chairman of the Board of Sloane-Blabon Corporation and executive vice-president of Alexander Smith Carpet Company, its parent organization.

From 1942 to 1944 Mr. Hudgins was on leave of absence for war service. He was director of purchases of the War Production Board and vice-chairman of the Joint Board of Procurement Policy from 1942 to 1944 and for the ensuing two years he was chairman of the Floor Covering Industry Advisory Committee of the War Production Board and the Office of Price Administration.

Other positions held by Mr. Hudgins are: chairman of the McLain Trucking Company, 1945 – 1952; director and member of the Executive Committee of Certain-teed Products Corporation, 1939 – 1945; director of Allied Overseas, Limited, 1946 – 1948; president of Hudgins and Ratsey, Limited, 1945 – 1950; director and member of the Executive Committee of United Cigar-Whelan Stores Corporation, 1945 – 1953. He is now serving as director and member of the Executive Committee of W. and J. Sloane, Inc.; and director of Wilson Brothers, Inc. His service as vice-president of Galen Van Meter, Inc., began in 1953.

Dr. Millsaps, who will be at M.I.T. for nine months, is widely known for work in physics, mathematics, and mechanical engineering as applied to aeronautical engineering. A graduate of Alabama Polytechnic Institute and the California Institute of Technology, he has been a consultant for many aeronautical firms.

For two years after his graduation, Dr. Millsaps was on the teaching staff of the California Institute of Technology. Since 1947 he has held faculty positions at Ohio State University in aeronautical engineering, and at Alabama Polytechnic Institute in physics. He has been associated with the Office of Air Research and the Aeronautical Research Laboratory recently, before going to Wright Field.

Dr. Fay, who graduated in Naval Architecture from M.I.T. in 1947, holds degrees as well from the Webb Institute of Naval Architecture and Cornell University. He has been assistant professor at Cornell since 1951, teaching in engineering mechanics and doing research in the graduate school of aeronautical engineering. Previously he was associated with the Terminal Island Naval Shipyard, Long Beach, Calif., and the Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio.

A native of Chicago, Mr. Johnson has studied at Indiana University, Central College, Chicago, and the University of Glasgow, Scotland, as well as the University of Chicago, from which he holds the M.A. degree in economics. Continuing advanced studies at the University of Chicago, he has been director of the management projects in the Industrial Relations Center, University of Chicago, since 1948, responsible for the management research programs.

In 1952 he served as assistant director of personnel administration at General Mills, Inc., Minneapolis, and in 1947 was a staff member of Robert N. McMurry and Company, Chicago, management consultants.

George A. Sloan: 1893 – 1955

GEORGE A. Sloan, Life Member of the M.I.T. Corporation, noted industrialist and for many years president and chairman of the board of the Metropolitan Opera Association, died in New York City on May 20. He was 61 years old.

As chairman of the United States Council of the International Chamber of Commerce since 1950, Mr. Sloan had been spokesman for American business in matters involving international affairs. His death came a few hours before he was to have been installed as president of the Chamber.

Mr. Sloan was born in Nashville, Tenn., where he was graduated Phi Beta Kappa from Vanderbilt University. He was admitted to the Tennessee Bar, but joined his father in business, a field in which he attained leadership. For more than 25 years he served as a director of a number of leading American corporations.

Mr. Sloan helped to organize the Cotton-Textile Institute, of which he was later president, and obtained improved working conditions for men, women, and children employed by mills. His government appointments through the years were numerous.

Administrative Assistant

THE appointment of Robert M. Briber, '52, as administrative assistant to James R. Killian, Jr., '26, President of M.I.T., was announced today by President Killian.

Mr. Briber, who is the son of Mr. and Mrs. Frank E. Briber of Denver, Colo., prepared for M.I.T. at the East Denver High School and entered the Institute in the fall of 1948. He received his degree of Bachelor of Science, Course XV-B, in June, 1952, and was awarded the degree of master of science in the School of Industrial Management the following year. During his undergraduate career Mr. Briber was president of the senior class; chairman of the Institute Committee and of the Inter-Fraternity Council Judicial Committee.

During the summer of 1952 and part-time until May, 1953, he served as a special assistant to the late Dr. Karl T. Compton in a special study pertaining to industrial research.

Franklin Warren Hobbs: 1889–1955

FRANKLIN Warren Hobbs, a distinguished leader of the New England textile industry and an emeritus Life Member of the Institute's Corporation, died at his Boston home on June 16.

Mr. Hobbs, who was the only manufacturer ever to head both the national cotton and wool manufacturer's associations, was born in Roxbury, Mass., and in 1889 received the degree of Bachelor of Science at M.I.T. After two years as an assistant in the Institute's department of mechanical engineering, Mr. Hobbs entered the employ of the Arlington Mills (now the William Whitman Company, Inc.). Throughout more than 60 years of service he assumed constantly increasing responsibilities, and in 1952 retired as chairman of the board of directors. Since 1930, he had served as board chairman of The Textile Foundation in Washington, D.C. For his leadership in the textile industries, Mr. Hobbs was awarded the honorary degrees of Master of Science by Dartmouth College, Doctor of Science by Middlebury College, and Doctor of Textile Science by the University of North Carolina.

J. Willard Hayden: 1874–1955

J. WILLARD Hayden, President of the Charles Hayden Foundation, Life Member of the Institute's Corporation and a member of its Committee on Student Activity, died June 15.

Mr. Hayden was born in Boston in 1874, and was educated at the local public schools and at Pennsylvania Military College. During World War I he was director of demobilization for the Y.M.C.A. In 1937, on the death of his brother Charles, Mr. Hayden severed a long association with the firm of Hayden, Stone and Company in order to devote himself to service as president of the Charles Hayden Foundation. His contributions as administrator of the foundation, established under the provisions of his brother's will, were important in terms of personal, as well as financial, assistance.

Technology's Sailors

WITH their successful defense of the Sir Thomas Lipton Memorial Trophy representing the team race championship and the Morss trophy emblematic of the individual championship of the North American colleges, Technology's sailors climaxed another season of victories in the New England and Eastern Championships. Representing the New England District of the Intercollegiate Yacht Racing Association of North America, M.I.T. met sailors from the Pacific Coast district in the finals, defeating them four races to one on the Charles River Basin. The Pacific Coast team composed of sailors from San Diego State College and the University of California at Los Angeles, won the honor of meeting Tech by a 4-2 victory over the Mid-Atlantic district composed of Georgetown and George Washington Universities. Mid-Atlantic district had won their elimination previously by defeating a Mid-West team 3-0 composed of Ohio Wesleyan and Cincinnati Universities.

The week of June 20 the team traveled to the United States Coast Guard Academy at New London where they successfully defended their National Intercollegiate Individual Championship sailing against the same Midwest and Pacific Coast colleges but with the United States Naval Academy and Princeton University replacing George Washington and Georgetown Universities for the Mid-Atlantic district. These two teams proved themselves to be the strongest competition with Navy scoring 210 points, Princeton 202 points and the M.I.T. sailors total of 217 points.

One more important event remains on their schedule. This tour comes as a return courtesy to Oxford University for their visit to the United States last year where they met many American Colleges in sailing races and visits to private clubs. They lost a year ago to M.I.T. in both the Lipton Cup races and the Denmark trophy at New London but prevailed in nearly half of their matches in this country. The American team will be made up of stars from different parts of the United States and will be captained by Alain de Berc, '55, a French citizen who has spent the past five years in the United States as a student, four of them at M.I.T. His familiarity with European sailing competition while at home during summer vacation, and understanding of the subtleties, protocol, and complications with which international yachting abounds, fits him for this position. He will have as team mates, Commodore J. Nicholas Newman, '56, William H. Stiles, '57, Donald Adams, San Diego State College and Bruce Loring, Rhode Island University, and his younger brother, who attends Stevens Institute of Technology.

The New England Intercollegiate Sailing Association honored M.I.T.'s late Athletic Director, Professor Ivan J. Geiger, through the presentation of a perpetual trophy which bears his name. The new trophy is in the form of a portrait of Professor Geiger mounted on a blonde wood plaque with silver plates and appropriate inscription. The trophy will be a constant reminder of the code of sportsmanship for which Professor Geiger stood and of his services to the North American college sailing organizations.

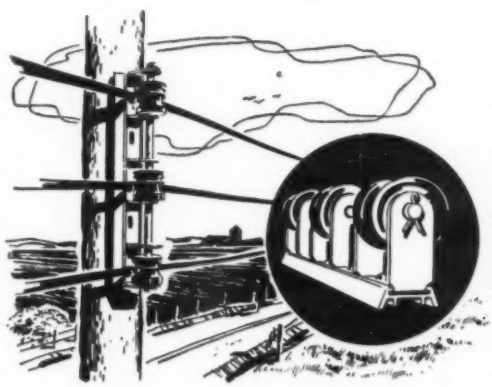
(Continued on page 500)

BUSINESS IN MOTION

To our Colleagues in American Business . . .

This is called a rack. It is fastened to electric light poles to hold wires from pole to pole, and from pole to house. Perhaps you may have noticed racks on poles, but unless your electric company has recently replaced them on the lines in your vicinity you have not seen anything quite like this. It is made of aluminum, instead of galvanized steel, and is assembled almost entirely of extruded shapes.

Naturally you will think that aluminum was chosen in order to save weight, and as a matter of fact, lightness plus strength is a factor. The aluminum rack is five to six pounds lighter, and that is appreciated by the linemen who have to put the rack on the pole after they have climbed it. However, lightness is not the main consideration. Long life is the big advantage. Modern methods of treating poles with preservatives make it reasonable to assume that a pole will last for 50 to 60 years. Now for the first time there is a rack or bracket, as it is sometimes called, that should outlast the pole. As soon as aluminum is exposed to the air, a thin film of oxide forms, and this is a protection against further action by air and rain. As for price, the aluminum rack costs a little more, but this is compensated, many times over, by the increased years of service.



There are some interesting features of design that are worth noting. The extruded shape that forms the base of the rack is adequately ribbed for strength, and in addition, provides a channel into which the arms are slid after having been notched and bent at right angles. The channel and the arms together take the pull of the wires; the rivets are used just for positioning. Incidentally, the rack has to withstand a total pull of 6,000 pounds. The arms are formed with a slight longitudinal camber or bow and have rounded edges, because linemen pull the wires across them, and the camber and edges protect the insulation from damage. The rod on which the insulators are threaded is extruded aluminum. One final detail, which is not easy to see in the drawing; the bottoms of the base are toothed, to hold to the pole better.

Revere takes especial satisfaction in this new and superior rack, because the Technical Advisory Service, the Mill, and the customer worked so closely together. There was a joint attack on the problem of developing a product that would not only be better, but could be assembled simply and economically. Suppliers to industry are not only well informed regarding their materials, but glad to cooperate with customers and prospects on matters concerning specification and fabrication. Revere suggests that you call upon your suppliers not only to fill orders, but to place their skill and knowledge at the disposal of your designers and production people.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

***Executive Offices:* 230 Park Avenue, New York 17, N. Y.**

Scale Model of AMF's "swimming pool" Unitized Research Reactor (pool and rear shielding cut away)

...from design through development to construction

One of the first industrial concerns to enter the highly specialized field of atomic research and development —with many of its engineers having experience dating back to the beginnings of the Manhattan Project —AMF has played a major part in many important and successful nuclear projects.

And its activities today are devoted not only to the completion of a variety of projects already begun, but to the installation, expansion, and improvement of atomic facilities for government and industry alike.

M. I. T. MEN ON THE AMF TEAM

S. F. Chalfin	1921	A. R. Buccini	1944
Denton Massey	1924	A. B. Burns	1946
S. Auchincloss	1927	J. F. McCarthy	1946
I. W. Hilliard	1932	E. W. Forth	1947
R. A. O'Brien	1934	R. B. Palmiter	1947
H. A. Quinn	1934	J. B. Williams, Jr.	1947
K. R. Rand	1934	H. B. Nelson	1949
J. E. Talbert	1935	C. Ajemian	1950
C. M. Graves	1936	W. K. W. Chen	1951
E. V. Kinsman	1936	J. L. DeClue	1951
S. V. Cuthbert	1937	J. C. Gilmore	1951
F. F. Ferrary	1937	J. F. Pasieka	1951
L. L. Holstein	1938	H. A. Ullman	1951
J. H. Brewster III	1940	H. P. Zitzow	1951
M. Sanders	1941	R. A. Boale	1952
J. F. Wilson	1941	D. A. Plummer	1952
B. M. Torrey	1942		

AMF ATOMICS Inc.

A subsidiary of

AMERICAN MACHINE & FOUNDRY COMPANY

AMF Building • 261 Madison Ave., New York 16, N. Y.

Basic AMF activities in the field of atomic energy include:

The development of **component machinery and mechanisms** for atomic reactors, including AMF's manipulator for nuclear materials and general purpose robot for use in radioactive areas.

Design and development of **complete research reactor systems,** including "heavy water", "swimming pool", and "water boiler" types.

Engineering conceptual designs for **power reactor plants** for industrial power supply—including AMF's closed cycle "boiling water" power reactor as well as "pressurized water" and "gas cooled" types—and active consultation with several **public utility groups** investigating this field.

Research and development in the field of "applied nucleonics", including the **radiation sterilization of foods.**

A continuing program in the field of **practical industrial applications** of radiation—an example of which is AMF's nucleonic "Microfeed" for exact control of tobacco weight per cigarette, already in use on "Standard" Cigarette Machines.

Specific AMF projects completed or under contract include:

Design and construction of special control rods and remote processing equipment for the **Hanford Engineering Works** of the **AEC.**

Design, development, and construction of the complicated control, handling, and processing equipment for the **Savannah River Facility.**

Construction of an AMF-designed "unitized" reactor of the "swimming pool" type for **Battelle Memorial Institute,** Columbus, Ohio.

Development of reactor control and handling equipment for the **Atomic Power Development Associates,** Detroit, Michigan.

Supply of complete AMF-designed "unitized" control units for **Oak Ridge National Laboratory.**

Design of a "pool" type, "unitized" **New York Area Industrial Reactor** to be sponsored jointly with representative firms in other leading industries.

Core and shielding in this AMF Research Reactor are similar to designs developed in AEC laboratories.

(*Continued from page 496*)

Aspects of Production

THE entire membership of the Visiting Committee on the Department of Mechanical Engineering met at the Institute for an all-day meeting on December 18, 1954.* The meeting was held in the recently completed Edward F. Miller Room with: James R. Killian, Jr., '26, President; C. Richard Soderberg, '20, Dean of the School of Engineering; Charles E. Fuller, '92, Professor of Theoretical and Applied Mechanics, Emeritus; and members of the Department's Faculty.

Professor Jacob P. Den Hartog, Head of the Department, outlined the Department's organization and undergraduate activities. Discussion was then directed to the desirability of offering an undergraduate course of instruction on Production. Although certain aspects of production techniques appear in the courses in machine tools, as well as in courses taught by the School of Industrial Management, the Institute does not offer an integrated course of study for those whose primary interest lies in this field. Presentations on several aspects of production were made by: Professors John A. Hrones, '34, and Robert W. Mann, '50, of the Machine Design Division; by Professors Milton C. Shaw and Prescott A. Smith, '35, of the Metals Processing Division; as well as by Professors Billy E. Goetz, W. Van Alan Clark, Jr., '42, and Robert B. Fetter, of the School of Industrial Management. The Committee shared the feeling of members of the Department of Mechanical Engineering that good undergraduate training in production methods could be obtained from existing courses of instruction which M.I.T. now offers.

The present requirements for the master's degree in Mechanical Engineering prescribe two courses in advanced mathematics, two in advanced mechanics, and one in heat, with the object of laying a broad scientific foundation without specialization. This program then does not fit the objective of a man who wants education in the mechanical engineering aspects of "production." However, there are available at the Institute a sufficient number of substantial courses in machine design, metal processing, and industrial management to constitute a one-year graduate program. The question was posed to the Committee whether or not it would be desirable for the Department to modify its requirements for the S.M. degree to permit the offering of a course in "Production," not necessarily containing advanced mathematics, mechanics, and heat.

After considerable discussion the Committee came to a unanimous conclusion that the Department should maintain its present high scientific standards for graduate degrees, and give further study to the formulation of a graduate program in Production based on courses of a fundamental character.

In the afternoon the Edward F. Miller Room was dedicated with addresses by John E. Arnold, '40, Associate Professor of Mechanical Engineering; who was responsible for the design of the room and its execution; by Sherman K. Grinnell, '52, a member of the student committee by whose efforts the campaign for the room was started; by Dean Soderberg, under whose administration as Head of the Department the entire development took place; by Professor Fuller, who had intimate personal and professional associations with the late Professor Edward F. Miller, '86; by Thomas H. West, '22, chairman of the Visiting Committee when the campaign for the room was undertaken; by Walter J. Beadle, '17, the present chairman; by President Killian; and by Professor Den Hartog, the new Head of the Department. The Miller Room will greatly enhance the relations between the staff and the students in the Department.

Finally, the Visiting Committee was favorably impressed by the dynamic manner in which the Department approaches its educational problems.

The above report was received for publication in The Review Office on April 25, 1955.

*Members of this Committee for 1954-1955 are: Walter J. Beadle, '17, chairman, Redfield Proctor, '02, John A. Lunn, '17, Charles A. Chayne, '19, George H. Burt, '20, Herbert G. Fales, '20, Thomas H. West, '22, John F. Bennett, '30, Lewis K. Sillcox, and Glenn B. Warren.

Course VI Study

ALL members of the Visiting Committee on the Department of Electrical Engineering were present at their last all-day meeting at the Institute on December 17, 1954.* In addition, Gordon S. Brown, '31, Head of the Department of Electrical Engineering, and several senior members of the Department's staff, were also present at most of the meeting, as well as James R. Killian, Jr., '26, President, and C. Richard Soderberg, '20, Dean of the School of Engineering.

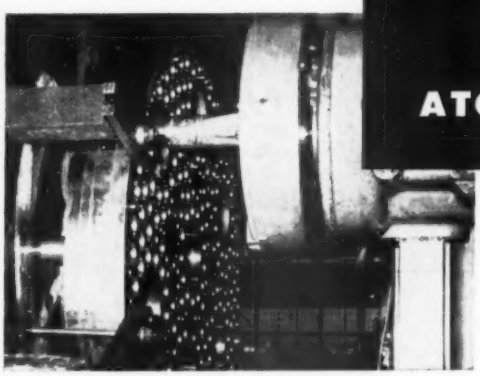
The Department is in the process of making major changes in its curriculum in which the former options in the fields of electric power, electrical communication, and illumination have been eliminated, and greater emphasis has been placed on electrical science which is fundamental to all phases of electrical engineering. Extensive changes have been made in the Department's laboratories to aid in achieving the newer educational philosophy. Visits were made to selected laboratories in order that the Committee might see how the laboratory work is now being coordinated with the revised curriculum. The laboratory tour also provided the Committee an opportunity to see the transition that had taken place in the type of experiments undertaken by the students, especially in the field of power, where machine operation has largely given way to a study of fundamental concepts. These laboratories have been rebuilt during the last two years and now provide a much more convenient arrangement with more adequate facilities.

*Members of this Committee for 1954-1955 are: H. B. Richmond, '14, chairman, Francis J. Chesterman, '05, Harland C. Forbes, '23, Max I. Alimansky, '28, Edward J. Poitras, '28, Theodore V. Houser, Alexander C. Monteith, B. Richard Teare, and Dean E. Wooldridge.

(*Concluded on page 502*)

One of Combustion's two plants at Chattanooga, Tenn., showing artist's renditions of new facilities now being built: (A) Nuclear Building; and (B) Wharf for water shipment of large nuclear power components.

LOOKING TO *our* ATOMIC FUTURE



Part of the nuclear power plant for the submarine, Sea Wolf, in process of manufacture in C-E shops. Precision workmanship is critical.

Cleanliness approaching good hospital practice is essential in the manufacture of nuclear reactor components.

Because Combustion took a long hard look at its atomic future years ago, today it is well along in its program for keeping abreast of nuclear power progress. And we intend to stay abreast of this progress for the very good reason that *power is our business*, whether its heat source is fossil, atomic or even solar energy.

How soon nuclear fuel will become economically competitive with fossil fuels has been only one factor in our planning which, from the start, has reflected the view that atomic power was here to stay . . . that it would be of growing importance in our future . . . and that our chief concern should be "how" rather than "when".

Where does Combustion stand today?

In the past year, we've nearly doubled the technical staff of our Nuclear Power Division, and we expect to maintain this rate of growth for some time to come.

Presently, we are building the huge reactor vessel for the country's first commercial-size nuclear power station — the AEC-Duquesne Light plant at Shippingport, Pa. Last year we completed manufacture of nuclear components for the prototype of the submarine, Sea Wolf, and we are now well along with the manufacture of this equipment as well as a set of boilers for the Sea Wolf itself.

We have begun construction of a new building at our Chattanooga plant (see upper picture caption) to house special facilities for nuclear work. Already on the site is a 15,000,000 volt betatron for fast X-raying of thick plate and welds. We are also building a wharf on our Tennessee River frontage which will be equipped to handle reactor vessels weighing several hundred tons, permitting water shipment of vessels too heavy for rail or highway. This program is scheduled for completion early next year.

Our already extensive research and development program has recently been augmented by an agreement with the AEC covering design and evaluation studies of large reactors for power stations, small reactors for special application, design of reactor fuel elements and development of fuel element fabrication processes.

* * *

Thus is Combustion preparing itself to participate significantly in the challenging task of applying nuclear fission to the power needs of the future.

8-841

COMBUSTION ENGINEERING

C-E

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

BOILER, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS AND FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE

THE INSTITUTE GAZETTE

(*Concluded from page 500*)

The Committee is aware that the Department of Electrical Engineering is now the largest at the Institute, and that it gives subjects of instruction to nonelectrical students as well as to Course VI students. The Department is also heavily associated with research problems carried on under Project Lincoln for the defense of the nation. It has heavy responsibilities and large requirements.

The effect that the revised curriculum will have on Course VI-A was discussed briefly. The Department has under study a program that will improve and strengthen the integration of the Course VI-A students with the Course VI students. As these are such important matters, the subject was deferred for a full discussion next year.

The greatest portion of the discussion was devoted to the revised curriculum for undergraduates. This new course of studies centering around a broad core curriculum may well prove to be as important as was the pioneer establishment of a course in electrical engineering at the Institute. As the use of electricity increased, so did the categories of specialization until they became an unmanageable complex which led more to a listing of vocations than to the broad concept of engineering based on electrical phenomena. This vocational trend tended to hold captive a body of students for a specific part of the industry, with no guarantee that they would find employment in their chosen field. Yet, many vacancies beckoned in a closely allied field for which the graduates had not been adequately trained. As Professor Brown so aptly said in his paper before the January, 1955, meeting of the American Institute of Electrical Engineers, an advance copy of which was made available to the Committee: "Options placed undue emphasis on learning the known art of today, rather than understanding the science that would dominate the art of tomorrow." This paper outlines the objectives of the Department and how they are being carried out. The Committee recommends the careful reading of this paper.

It has been the duty of the Committee to see that the desired objectives are reasonable and that the reaction of staff and students to them is healthy. There were, naturally, a few of the staff who found it difficult to part with the option type of program and to substitute the more general core type of approach. Your chairman, who has had the opportunity of studying this evolution during the past three years from a rather close range, feels safe in saying that the staff of the Department have shown real enthusiasm over the change, in spite of the fact that the transition has placed a heavy burden on them. The Committee recommends that the program be pushed forward vigorously, subject to such changes as experience may dictate; and that, as far as is practical, information from the employers of the 1955 graduates of the new course be obtained as soon after graduation as is feasible.

Why Is M.I.T. Established Beside The Charles?

Read—

When M.I.T. *was "Boston Tech"*

by Samuel C. Prescott

xviii + 350 pages
with
14 pages of pictures

$6.00
postpaid

THE TECHNOLOGY PRESS
Room 14N229
Mass. Inst. of Tech.
Cambridge 39, Massachusetts

My check for $..... is enclosed herewith for ..... copies of *When M.I.T. was "Boston Tech."* Please mail by prepaid parcel post to:

_____

_____

_____

Calling all

SIDEWALK SUPERINTENDENTS...

EVERYONE enjoys watching a construction job in progress. And engineers should get particular pleasure from watching the erection of our new, modern office building in Waltham, Massachusetts. Handsome and functional in design, the new building will embody all the latest principles of fire-resistive construction. Walls will be brick-faced cinder block over steel framing, and the entire building will be sprinklered and air conditioned. It should be a wonderful place to work.

THE site, too, was chosen with working conditions in mind. It is one of unusual natural beauty — on a hilltop overlooking a large lake — far enough from downtown Boston to enjoy all the benefits of suburban location, yet close enough to be easily accessible.

SINCE it *is* but a short ride, why not drop out next time you're in the Boston area? We think you'll enjoy seeing the kind of workplace we're building. We'll be there after August 1.

Boston Manufacturers and Mutual Boiler and Machinery Insurance Companies

60 BATTERYMARCH STREET, BOSTON 10, MASSACHUSETTS

MARSHALL B. DALTON '15
President

GILBERT M. RODDY '31
Vice President

ROBERT L. JOHNSON '38
Treasurer

Announcement

is made of the formation of

a New Company

HYCON
EASTERN
INC.

for the purpose of

RESEARCH, DEVELOPMENT, and MANUFACTURE

in the fields of

MODERN COMMUNICATIONS
DATA PROCESSING
NEW ELECTRONIC COMPONENTS
SYSTEMS ENGINEERING
NUCLEAR TECHNIQUES

75 Cambridge Parkway
Cambridge 42, Massachusetts

KIrkland 7-3803

Malcolm M. Hubbard,
President

AND DEPARTING—

(*Continued from page 493*)

than a quarter of a century. It would be easy and pleasant to recount the major achievements of Mr. Rowlands which were partly responsible for his election as Honorary Member. A more effective presentation can be made by citing – as was done at the presentation ceremony – the evaluation placed upon his work by Edward T. Weeks, editor of *The Atlantic Monthly*. Neither a Technology Alumnus nor a member of the M.I.T. family, Mr. Weeks stated, in an article in the Boston *Herald* of February 18, 1950: "In my judgment the best public relations in the college world over the past 25 years have been those maintained by James Rowlands at the Massachusetts Institute of Technology. Jim has devoted himself untiringly to the proposition that people all over the country are not only willing but eager to understand what M.I.T. is doing.

"He has opened the doors of Tech to writers who wanted to know. Working quietly and usually anonymously, Jim has made it his business to explain to the United States what M.I.T. had contributed to the development of our science and industry, and the enormous part it has played in our national defense. When Tech staged its magnificent inauguration of President Killian with the Churchill speech and the brilliant symposia which followed, Jim was again a quiet force behind the scenes, helping to make the big ideas accessible."

(*Continued on page 506*)

ON YOUR VACATION
in New England visit

MIT
Instrumentation
laboratory

RESEARCH

ENGINEERS

INERTIAL GUIDANCE AND WEAPONS FIRE CONTROL

- SYSTEMS
- COMPONENTS

Graduate Courses

MAY BE TAKEN FOR ACADEMIC CREDIT
WHILE EARNING FULL PAY

Write

MARTIN PHILLIPS
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
INSTRUMENTATION LABORATORY
68 ALBANY ST.
CAMBRIDGE 39, MASS.

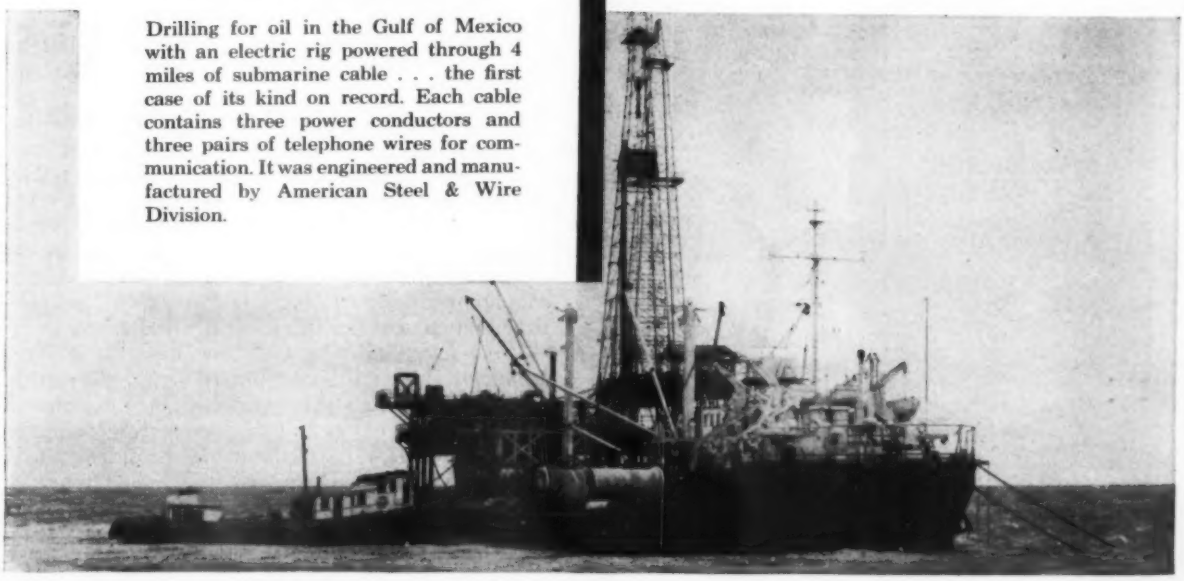
Engineering Achievements

USS TIGER BRAND WIRE ROPE

1,161,155 cubic yards of overburden were moved in 23 days by this huge electric shovel. It scoops 50 cubic yards in one bite. A special hoist rope was designed and manufactured by American Steel & Wire Division to do this rugged work at a record clip. Only one hoist rope was used in the process.

USS AMERICAN ELECTRICAL WIRE & CABLE

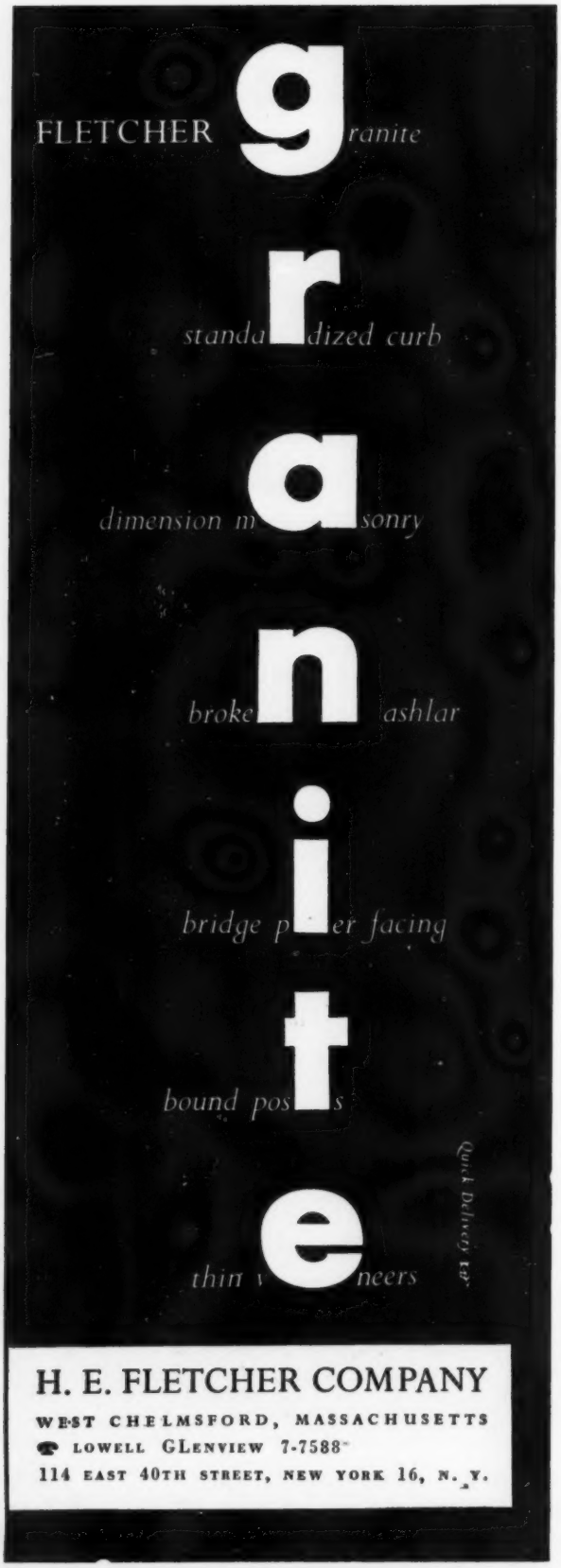
Drilling for oil in the Gulf of Mexico with an electric rig powered through 4 miles of submarine cable . . . the first case of its kind on record. Each cable contains three power conductors and three pairs of telephone wires for communication. It was engineered and manufactured by American Steel & Wire Division.



AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL
GENERAL OFFICES: CLEVELAND, OHIO

USS

UNITED STATES STEEL



AND DEPARTING—

(*Continued from page 504*)

Mr. Ferguson then introduced Robert W. McLean, '05, and John F. Bennett, '30, who made gift presentations for the 50 year class and the 25 year class, respectively. Mr. McLean presented to President Killian a check for $161,215. For the 25-year class, who left M.I.T. at the beginning of the depression, Mr. Bennett presented a check for $52,082.38, of which $20,910 was accounted for by class group insurance policies taken out while members of the Class of 1930 were still students. President Killian graciously accepted both checks on behalf of the Institute, and assured the assembled Alumni that these funds would be put to good use.

Theodore T. Miller, '22, Chairman of the Alumni Fund for the current year – and reappointed to serve for the coming year – reported on the Alumni Fund. He told the audience that 10,700 Alumni had contributed half a million dollars – an amount more than double that in any other year. He also reminded Alumni that an anonymous donor had agreed to equal any amount collected by the Alumni Fund. Accordingly, Mr. Miller was able to report that the Alumni Fund this year would amount to one million dollars. This is a splendid tribute to Karl Taylor Compton, in whose honor the fund was earmarked this year, and also to Mr. Miller and others who took responsibility for administering the fund for the current year.

Next event of the evening was the address given by Dr. Arthur S. Flemming, Director of the Office of Defense Mobilization. In opening his address, Dr. Flemming paid handsome tribute to President Killian who has rendered to our nation service of a high type in connection with classified matters of national defense. Dr. Flemming could not reveal the nature of the work that, during the past has taken Dr. Killian away from the Institute for several months, but he indicated the service was regarded as exceptionally valuable.

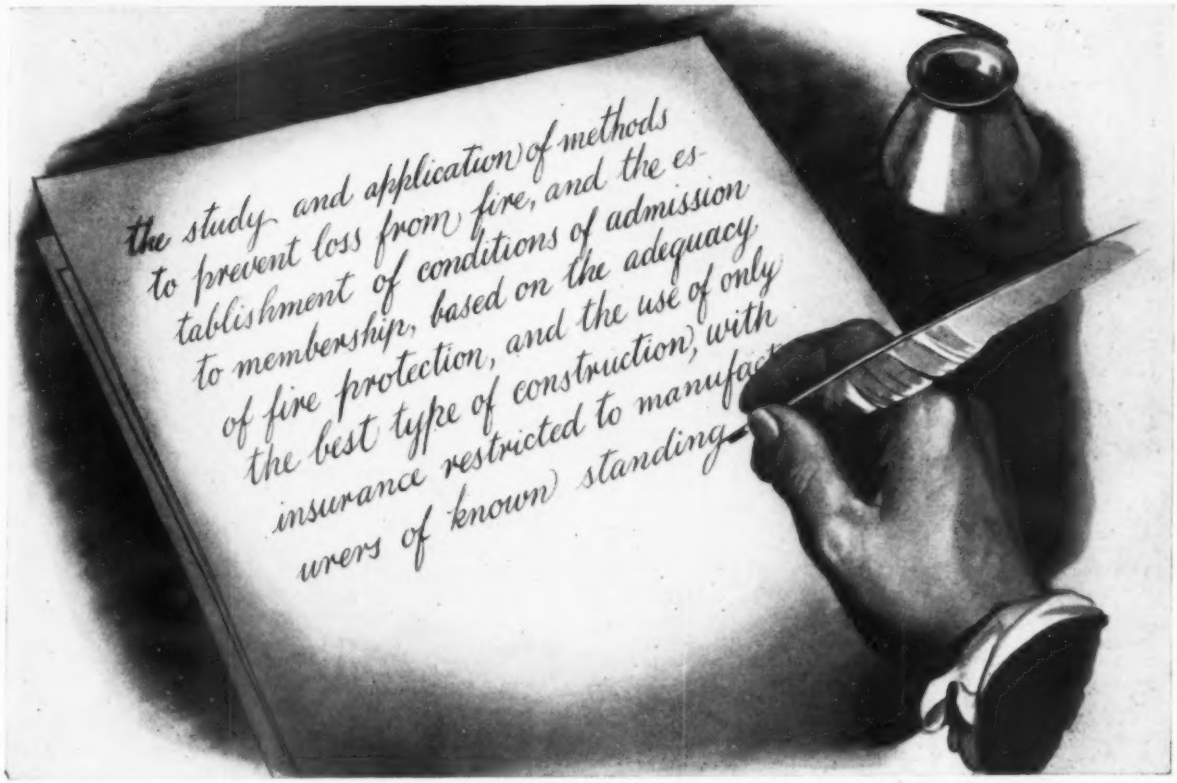
Dr. Flemming also expressed gratitude to the Institute for its superb training of students in science and engineering, and for the availability of public spirited, able Alumni who, in later years, have often taken positions of trust and great responsibility in industry, in government, in education and in research. The essence – if not the exact words – of Dr. Flemming's address, "Is War Inevitable?" is published on page 483 of this issue of The Review.

When Dr. Flemming had concluded his address, President Ferguson spoke briefly of his pleasure in having the privilege of being president of the Alumni Association for the past year, gave profuse thanks to H. E. Lobdell, '17, Executive Vice-president, D. P. Severence, '38, Secretary Treasurer, and Henry B. Kane '24, Alumni Fund Director for the able and valuable assistance they had rendered in making his task the easier during the past year.

Mr. Ferguson then turned over the gavel of his office to Dwight C. Arnold, '27, who spoke with pleasure and humility in taking over the reins from Mr. Ferguson, and who adjourned the meeting at 9:30 P.M.

(*Concluded on page 508*)

How we said it in 1835...


the study and application of methods
to prevent loss from fire, and the es-
tablishment of conditions of admission
to membership, based on the adequacy
of fire protection, and the use of only
the best type of construction, with
insurance restricted to manufac-
turers of known standing

...and still true today!

Although the above statement was written 119 years ago, when Andrew Jackson was President of the United States and Texas still belonged to Mexico, it could have been written today!

As the oldest and largest of the Factory Mutual Companies, we still base our operation on Loss-Prevention. Trained field engineers and laboratory technicians are at work constantly for policyholder members . . . the ultimate goal being maximum protection at minimum cost.

If you are not acquainted with the details of this mutually beneficial operation, call in a Manufacturers Mutual Engineer. He will be glad to see you, at your convenience, without obligation.

N. B. "Tech" men predominate in the more important positions of the individual companies that make up the Factory Mutual Group and of the jointly operated Factory Mutual Engineering Division.

Hovey J. Freeman '16
PRESIDENT

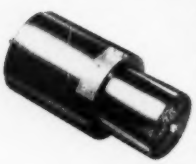
MANUFACTURERS MUTUAL FIRE INSURANCE COMPANY

1500 TURKS HEAD BLDG., PROVIDENCE 1, R. I.

Over $55,000,000,000 Insurance In Force in the Factory Mutual Companies

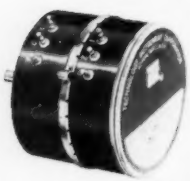
in electronics:
ELECTRICAL & MECHANICAL PRECISION
has always been anticipated
by TIC
Imagination and resourcefulness at TIC have set the standards for potentiometers and many fine measuring instruments.

LIQUID COMPONENTS!



To produce potentiometers having no frequency discrimination or phase shift over a 10 Mc. band, TIC has utilized a lossy dielectric liquid in which shaped electrodes are rotated with respect to each other. The dielectric capacity and resistivity of the liquid become continuously variable components of a multiple element RC network which provides voltage division free of frequency or phase distortion.

PRACTICALITY AND PRECISION



The new LOW COST P series of potentiometers are particularly adapted to those commercial uses where a substantial number of them are required per assembled unit and where high performance requirements force designers to keep a wary eye on narrow cost margins. Their wide range of sizes and resistances fit them for automation, test equipment, data handling systems, measuring instruments and computer uses.

MINIATURIZATION WITH PRECISION

The new Type L10S miniature multi-turn potentiometer, little 7/8" diameter units, provide continuous adjustment thru 3600°. Featuring extremely fine resolution and very low torque, these units can be produced with 0.025% linearity.

EXTENSION OF MEASUREMENT

TIC's new EXTENDED RANGE TYPE 800A VACUUM TUBE VOLTMETER is a measurement laboratory in one compact instrument. With great accuracy and stability it measures voltages from DC to 100Mc. 0.01 volt to 300 volts AC, 1000 volts DC, resistance from 0.02 ohms to 5000 megohms — direct current from 1 millimicroampere to 100 milliamperes.

TIC's new EIGHT CHANNEL DIRECT WRITING OSCILLOGRAPHIC RECORDER has been designed to record faithfully from DC to 900 cycles, a great extension of the range common in direct writing instruments. Very high trace definition makes extremely clear oscillograms. An additional channel is provided for use as in marking or referencing. Up to 40 minutes of recording time is available, depending upon which tape speed is chosen.

M. I. T. Graduates at T. I. C.	Class of
LUCIUS E. PACKARD	1935
RICHARD W. HOUGHTON	1944
HOLLIS L. GRAY JR.	1950
CAXTON FOSTER	1950
FRED W. ALDRICH JR.	1951
CARL NELSON	1952
RICHARD D. WARD	1955

TECHNOLOGY INSTRUMENT CORP.
527 Main St., Acton, Mass. COlonial 3-7711
P.O. Box 3941, North Hollywood, Calif.

AND DEPARTING —

(*Concluded from page 506*)

Those who heard the bounteous words of praise which President Ferguson bestowed upon its paid officers must have felt a warm glow of satisfaction in the knowledge that the Alumni Association so handsomely fulfills its mission. Especially on occasions such as that reported here, it is pleasant to recall that, just as generals alone do not win battles, so too there are others who make major contributions to the success of the Association. They do not sit at head tables; they do not take the bows; they do not initiate policies for others to implement. Theirs is the less exciting, yet equally important, task of doing the jobs that need to be done.

In the Alumni Office, Miss Madeline McCormick, Assistant Treasurer, bears the brunt of administering bookkeeping, clerical, and address operations, with the able support of Mrs. Doris Sears Evans, Miss Irene Walker, and others. Records of the Alumni Fund are the responsibility of Miss Virginia McPartland. Mrs. Eleanor Smith managed records and production for the new *Alumni Register*. Mrs. Lillian Unversagt and Miss Esther Marvin loyally support the Executive Vice-president and Secretary-Treasurer.

With increasing responsibility as production costs rise and as the Association grows, The Review has more than paid its way since 1928; today it operates with the same size working personnel it had more than a decade ago. Miss Ruth King, Miss Eileen Klimowicz, and Miss Evangeline Sferes carry the load for editorial, advertising, and class notes production, respectively.

It is fitting and appropriate to recognize and acknowledge the services of this loyal group. Without them, or their equivalents, there would be no army.

Conclusion

As Alumni and their ladies left their respective banquets at the end of Alumni Day, they could look back on happy hours spent meeting old friends, visiting the new M.I.T., or listening to stimulating addresses. Many took home memories of another class reunion and some, for the first time, had the thrill of being Technology Alumni. These Alumni — and their ladies — all had lived a day sublime, and departing left behind them plans to meet another time.

William H. Coburn & Co.
INVESTMENT COUNSEL
68 Devonshire Street
Boston

ENGINEERS,

How Would You Like to Tackle this Problem?

CONVERT 0.05° to 0000000000001

To design an analog-to-digital converter to measure and read out directly, in digital form, to 3" of arc, the angular position of a shaft turning at an angular velocity of 1000° per second—WITHOUT LOADING THE SHAFT.

It is typical of engineering problems at ECA in that it requires non-typical thinking to solve it ...the solution can't be found with engineering handbook procedures.

Daily ECA engineers and physicists are called upon to by-pass standard procedure... to exercise ingenuity in devising new, more effective approaches.

This kind of thinking has earned ECA its reputation for repeatedly coming up with ingenious but practical solutions to the most complex problems, and has led to the development of established and widely accepted commercial products.

It is no accident that ECA comes up with the right answers, however, for ECA's engineers are selected with unusual care. They're imaginative, broad of outlook... men with varied interests. It takes men like these to keep ECA ahead of the field—to develop automatic controls, digital and analog computers, electronic business machines.

There's room at ECA for more men of this calibre. Inquiries are invited. Please send resumes to Mr. W. F. Davis, Dept. 720.

ELECTRONICS CORPORATION OF AMERICA

77 Broadway Cambridge 42, Mass.

TECHNOLOGY OF PEACE

(*Continued from page 478*)

school system. We are at the same time deeply convinced that the real and fundamental manpower scarcity is a scarcity of quality more than of numbers, and that the problem of providing adequately for the exceptional young people of our time is as urgent and commanding as the problem of preparing for the tidal wave of numbers. In my judgment the under-privileged youngster of our school system is all too frequently the superior and exceptional youngster. In recent years we have achieved a system of mass education which is magnificent in its accomplishment and its extent. We must maintain this system in a state of vigor and we must make sure that we enable it to meet the swelling numbers that result from our population growth. But more than this we must make sure that it has built into it the methods, the ideals, and the people who will spot the able youngsters and will give them special handling so that they have a maximum opportunity to make their contribution to our society. At the present time one third of the top 2 per cent of the graduates of our high schools are not going to college. Some are not motivated; some do not have the means. We must provide the motivation and the means for more of this missing one third to get a college education. We must take every means we can to insure that we realize the full potential of our best minds.

One of the reasons why we have not been doing as good a job here as we might is the fact that we have not given our teachers adequate incentive and status in our public school system and that particularly we have let the teaching of science be gravely weakened since the war. It is estimated that this June, the teachers' colleges and other institutions producing teachers in the nation will turn out less than 250 teachers of physics for our secondary schools. It has also been estimated that the average college training of our teachers of physics in the secondary schools is six-tenths of one college semester.

It is further estimated that we are currently preparing only about half the number of science teachers that we are to need in the next five years. Here is a critically urgent situation that warrants a vigorous and systematic attack. In saying this, I hasten to add

(*Continued on page 512*)

ENGINEER
ELECTRICAL DESIGN

Excellent opening in expanded Design Department of leading control company. Design of electro-magnetic switches and controls to 1000 amps. Permanent position. Opportunity for technical and financial advancement. Send resume to G. Franklin.

AUTOMATIC SWITCH COMPANY
391 Lakeside Avenue, Orange, N. J.

PLASTICS RESEARCH & DEVELOPMENT

DeBELL & RICHARDSON, INC.

Hazardville, Connecticut

A completely integrated development organization covering technology and economic phases of the polymer and plastics field. Staffed with professional competence in monomer and polymer research, material and product development, process and equipment development and full scale manufacturing plant layout and design.

• • • •

D & R PILOT PLANTS, INC.

Offering to industry facilities for the pilot manufacture of synthetic resins, plastics and related products.

• • • •

D & R PLASTIC WELDERS, INC.

Plastic fabricators and distributors of plastic welding equipment.

John M. DeBell, X-A '17
H. M. Richardson, B.S. (E.E.), U. of Colorado '25
M. H. Nickerson, V '37
F. D. DeBell, X '44
S. B. King, V '47
R. S. DeBell, IX '48
XV '49
J. E. Curtis, X '50

CAN "KNOW-HOW" HELP YOU IN PROCESSING THE ATOM?

For six years it has been our privilege to serve the nation on atomic work. As Pipe Fabricators and Mechanical Contractors, we fabricated and installed miles of pipe at Oak Ridge, Tennessee. Work included process piping, equipment setting, instrumentation, etc., at the giant K-33 plant (33 acres under one roof) where U-235 is produced.

We are proud to be a growing part of such a vital American industry, and salute the progressive spirit that is so prevalent throughout the industry today—and that holds such promise for the future.

KAIGHIN & HUGHES, INC.

Piping & Mechanical Contractors

Toledo Ohio Akron

Samuel Waldman '31
Alfred Abboud '22

MAIL RETURNS

(*Concluded from page 450*)

I included the statement in a small volume that I recently published: "And very definitely our co-operating task of tomorrow is learning how to train and to guide these combinations of electrons – these elements of human life – that control our desires, our creative power, in a manner that shall be comparable with the guidance that we now traditionally exercise over our more passive skills of memories and our faculties of deductive reasoning."

To show that I am not alone in regarding these *desires, motives,* and *wills,* which I put together under the phrase of Moral Energies, I would like to quote Doctor John S. Dickey, President of Dartmouth. He regards the purpose of education as: "A. The will to achieve; B. The capacities to achieve."

You will notice that he puts the "will for constructive accomplishment" ahead even of the capacity for the same. Now returning to the Limitations of Technology's program which you described as primarily the development of logical thinking, in my opinion, this would not be quite so bad if it were in reality an effectively just that. According to my observation, however, Technology's discipline is memorizing a vast mass of miscellaneous technical facts, text-book and lecture-notes details and conclusions resulting from bits of so-called logical thinking.

Dedham, Mass.

TECHNOLOGY OF PEACE

(*Continued from page 510*)

that I am not one of those who feel that the teaching of science should be given such exceptional attention in our public schools that it results in weakening or distorting the emphasis on other fields. This is not the way to solve the problem, but I do think the evidence is clear that we have permitted our science teaching to suffer to a greater extent than the teaching in any other fields in the secondary schools.

Much of our progress in strengthening science at the college level will depend upon our national success in identifying, encouraging, and leading on the superior and exceptional youngsters in their pre-college schooling, but we have responsibilities to do the same kind of thing in our colleges. I do not advocate limiting college education to an intellectual elite. This would not be good for our fluid society. I do advocate diverse kinds of colleges, some of which will see their responsibility to lie in the direction of very high selectivity and a level of excellence that represents the highest achievable standards of our intellectual and cultural life. M.I.T.'s responsibility is of this kind and whether we can still further increase our enrollment depends upon whether such an increase can be accepted without any compromise in these standards of excellence. The maintenance of quality is more important to the nation than our engaging in an academic numbers race with the Rus-

(*Concluded on page 514*)

STANDARD

STANDARD OIL COMPANY

(INDIANA)

910 South Michigan Avenue . . . Chicago 80, Illinois

Fairfield & Ellis
INSURANCE

SIXTY
CONGRESS STREET
BOSTON

AL STAINLESS STEEL

PIONEER IN SPECIALLOY STEELS

PRODUCTS

STAINLESS STEELS	CARMET CARBIDE METALS
TOOL STEELS	ELECTRICAL ALLOYS
ELECTRICAL STEELS	LAMINATIONS
EXTRUDED SHAPES	PERMANENT MAGNETS
MAGNET STEELS	VALVE STEELS
CAST CUTTING ALLOYS	HIGH SPEED STEELS
NITRI-CAST IRON	COMPOSITE DIE SECTIONS

TOOL STEEL CAST-TO-SHAPE
SUPER-ALLOY STEELS FOR HIGH TEMPERATURES

PLANTS

Brackenridge, Pa.
Watervliet, N. Y.
Wallingford, Conn.
Detroit, Mich.
West Leechburg, Pa.
Dunkirk, N. Y.
Marengo, Ill.
Los Angeles, Calif.

ALLEGHENY LUDLUM STEEL CORPORATION

Oliver Bldg., Pittsburgh 22, Pa.

The Nation's Leading Producer of Stainless Steel in all Forms

We're proud to include the following alumni of Massachusetts Institute of Technology among our personnel.

Edward J. Henley	'24	Dr. P. K. Koh	'39
R. M. Arnold	'22	William J. MacDonald	'51
Henry M. Butler	'50	Richard K. Pitler	'49
James C. Fulton	'53	A. H. Riehl	'41
Dr. Laurence C. Hicks	'33	Clifford J. Rounds	'52
Thomas F. Kaveney	'50	Richard P. Simmons	'53

TECHNOLOGY OF PEACE

(*Concluded from page 512*)

sians, or with any other country. If we can maintain and augment our quality, then we have an obligation to try to admit more students, just as we have already done since the war. I have no sympathy for the smug view of a few private institutions that the problems of increasing enrollments is not for them but for somebody else. I do strongly feel that some of our institutions must make excellence and leadership their primary objectives, and that M.I.T. is one of these.

In picking out these aspects of our financial and educational role and policy, I am not unmindful of some of the other urgencies which press upon us as a great institute of technology serving a world clientele. Survival is the chief intellectual problem of our time, and no educational institution that conceives of itself as indigenous to our times and close to the needs of our society can fail to concern itself with the urgencies of survival. For this reason M.I.T. and its people have undertaken heavy responsibilities, including major undertakings to mobilize science for augmenting the military strength of the free world.

Survival as an intellectual problem, however, involves a great deal more than military strength. It involves the maintenance of a society strong in its economy, its will, its confidence, and its moral purpose. It requires a preoccupation with those matters of the mind and spirit which give a society coherence and its people courage and stamina. It involves freedom of thought along with freedom for each man to realize his fullest potential. Survival involves the cultivation of a core of human excellence and integrity that can stand unafraid and unbowed before the prospect of horror and catastrophe.

As I have tried to suggest, our institution concerns itself with this whole range of intellectual and moral problems associated with survival; and as I observe the abundance and creativeness of its intellectual life, I see not darkness but light ahead.

Although we will face great hazards and even stalemate in the years ahead, the problems of the H-bomb and of the cold war, brutal and unrelenting as they are, need not be wholly insoluble or inevitably catastrophic. In a time of fear and stress, this is the hope that arises from the search for understanding in our great universities. This is the promise and the glory that resides in the ever-renewing creativity of young minds working with freedom and seeking to understand.

SCULLY SIGNAL COMPANY

Safe Fills
No Spills
with VENTALARM®
WHISTLING TANK FILL SIGNAL

for automotive, home and diesel fuel tanks

F. P. Scully '15
174 Green Street, Melrose 76, Mass.

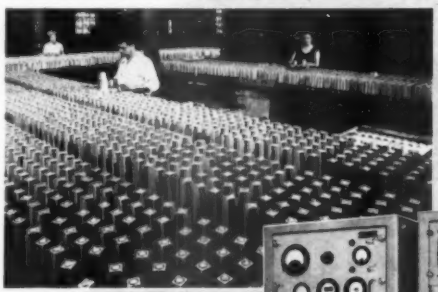
"JUST FILL 'TIL THE WHISTLE STOPS"

Leadership...

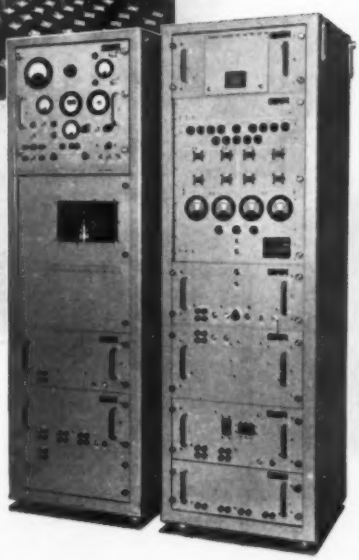
ELECTRONICS • MISSILE TEST & CHECK-OUT • RECONNAISSANCE SYSTEMS

HYCON DIGITAL VOLTMETER MODEL 615
One of a complete line of electronic test instruments.

ORDNANCE PRODUCTS
Precision production of complex materiel for the armed forces. Here is a "factory-full" of Mighty Mouse sub-assemblies.



AERIAL CAMERAS —SURVEYS
Hycon aerial reconnaissance systems and cameras are used throughout the world. Hycon Aerial Surveys is now mapping areas of many countries. Photos show Hycon Military Reconnaissance Camera (Model K46) and above, map technicians at Aerial Survey Division.



FIELD TEST EQUIPMENT
Hycon leads in development of test and check-out instruments. Photo shows "GO NO-GO" missile test set AN/DSM-2.

Massachusetts Institute of Technology graduates at Hycon Mfg. Company include:

- **Alden E. Acker, President, Class of 1937**
- **Duane Wood, Executive Vice President and General Manager of Hycon Aerial Surveys, Inc., Class of 1937**
- **George Turner, Research Electronics Engineer, Class of 1945**
- **Robert Nordman, Junior Mechanical Engineer, Class of 1951**

Hycon
Mfg. Company

SEVEN PLANTS IN PASADENA

MAIN OFFICE
2961 East Colorado Street
Pasadena 8, California

"WHERE ACCURACY COUNTS"

This summer you'll want cool and comfortable clothing . . . .

. . . . . HASPEL SUITS

Prado Cord Suits are cool, unlined, shape-retaining and wrinkle-resisting. Their Fleet model styling provides that slim, youthful trim appearance.

$26.50

Sir Perior Suits are 75% dacron and 25% cotton. This combination gives you many advantages in hot-weather wear . . . wash it, hang it out, then wear it without ironing.

$39.75

Featherweight Cord Suits are 85% dacron and 15% nylon. Science gives you this lightest weight washable cord . . . a truly luxurious fabric that attains the height of practicality.

$50.00

. . . . . HASPEL JACKETS

One or two Haspel Cruiser Jackets combined with two or three pairs of slacks will give you an almost unlimited, ever changing and ever fresh hot-weather wardrobe. Light weight, cool, comfortable, these Cruiser Jackets are smart and fresh in appearance.

$18.50

3-MONTH PAYMENT PLAN AVAILABLE

PATRONAGE REFUND TOO

Tech Men please note that membership in the Technology Store entitles them to the Patronage Refund on purchases made in the Harvard Square Store. Tech Graduates may join at either store.

The COOP

Harvard Square Store

FREEDOM IS A NOBLE THING

(Continued from page 479)

Freedom is also a noble thing because of what it makes possible. The mind of man may be unconquerable, but it cannot operate without freedom. Surely there is no need to labor that point in a place like this, where the ideals of scientific research are in the very life-blood of the institution. But there are places in the world today – and they are not all of them behind the iron curtain – where freedom of thought and expression is challenged, sometimes bluntly but more often, I think, subtly; and it cannot be too often stated in plain words that without freedom the search for truth is impossible.

Equally impossible is the work of the creative artist unless he lives in an atmosphere of freedom. Much splendid work – in literature, in painting, in music – has been done in protest against tyranny; but, unless I misread badly the actual history of the world, the great works of art have all been produced by men whose souls were free. And the same thing is true in the realm of spiritual values. Only free men – men born free or men who with a great price have bought their freedom – can catch those glimpses of eternal truth out of which all human insight into the world of the spirit and the purposes of God has been fashioned. The new awareness of the ultimate meanings of life, for which our times are so terribly an-hungered, can come only, as the Hindu poet phrased it,

"Where the mind is without fear and the head is held high:
Where knowledge is free:
Where the world has not been broken up into fragments by narrow domestic walls:
Where words come out from the depth of truth;
Where tireless striving stretches its arms toward perfection:
Where the clear stream of reason has not lost its way into the dreary desert sand of dead habit."

Freedom is a noble thing because of what it shall yet make possible, because it is the indispensable prerequisite for all progress in the things that have substance and color and perhaps even a hint of ultimate value to civilization.

(Continued on page 518)

Hotel **COMMANDER**

CAMBRIDGE, MASS.

By the Common facing Harvard and Radcliffe Colleges

315 rooms of which 120 are transient single rooms and suites and the remainder consist of 1, 2, 3, and 4 room completely furnished housekeeping units. Open air Sun Deck.

Colonial Dining Room **Cocktail Lounge**

9 Function Rooms accommodating up to 650 persons

Ten minutes by bus from M.I.T. **AAA recommended**

Headquarters for Rotary, Kiwanis, Exchange and Quota Clubs.

BASKETBALL
America's most popular line of basketball shoes

HUNTING
Quality that every hunter appreciates

FISHING
Nationally advertised, universally preferred

CASUALS
Cool, colorful footwear for the whole family

CONVERSE

COLD-WEATHER SPORTS
Warm feet in the coldest weather

Quality Craftsmanship in waterproof and canvas footwear for over 47 years

L. P. SANBORN '17 • A. H. WECHSLER '21
F. L. HALL '25 • R. E. GLADSTONE '40

CONVERSE RUBBER COMPANY
MALDEN 48, MASSACHUSETTS

CHICAGO 6: 564 West Monroe St.
NEW YORK 13: 241 Church St.
SOUTH SAN FRANCISCO: 100 Freeway Blvd.

Just off the Press:

1955 ALUMNI REGISTER

LISTING alphabetically within its 642 text-pages: 47,210 living alumni (from Aall, Jacob '50 of Tvedestrand, Norway, to Zych, Edward A. '45 of Chicopee, Mass.); 11,968 deceased alumni (Abare, Lawrence P. '30 to Zitz, Frederick C. '95); 388 members of the Corporation since 1862; 9,119 members of the Faculty and Staff since 1865; and 196 officers and Executive Committee members of the Alumni Association since 1875.

All alumni, living and deceased, are cross-indexed according to Class affiliation; and 44,274 alumni (94 per cent of those living) are cross-indexed geographically according to their addresses as corrected to February 15, 1955.

Over 6,300 copies, ordered by "advance subscribers," have been delivered. . . . Additional copies *paperbound* for post-publication sales are now available and orders at $6.00 per copy postpaid will be filled in the order of their receipt by the

Alumni Association
Room 1–280, M.I.T.
Cambridge 39, Mass.

FREEDOM IS A NOBLE THING

(*Continued from page* 516)

Freedom is not only a noble thing. It is also a fragile thing. In the passage from "The Brus" which formed the text of "The Canticle of Freedom," the poet tells us "A noble heart may have no ease, Nor aught beside that may him please, If freedom fail." If Freedom fail! Clearly, in the light of what has happened in the world since 1914, this is not a theoretical or remote possibility, but a serious and continuing threat to which all of us and all our institutions are continually and seriously vulnerable.

We have not, in recent years been unaware of this peril; and we have made many strenuous but not very successful efforts to avert it. But it seems to me that we have been strangely reluctant to recognize its real nature.

We have been inclined to center our attention upon the external and superficial causes of the threat to freedom and then to put our reliance upon correspondingly superficial measures to prevent it. The all-important thing about freedom, as I view it, is that it resides, and can only reside, in individual minds and hearts. When it fails, it is because an individual has failed to resist and has surrendered; and the reason for his surrender is that he has not maintained and nurtured the basic philosophical and spiritual life that is the soil in which freedom lives and grows.

Men abandon freedom because they grow tired of

Nuclear Science and Engineering Corporation

P.O. Box 10901, Pittsburgh 36, Pennsylvania

A service, research and development organization staffed and equipped to solve many of the nuclear measurement problems for the atomic power industry and to expedite for clients the new industrial applications of radioactivity.

RONALD A. BRIGHTSEN, M.S. '50	PRESIDENT
DR. CHARLES D. CORYELL, *Professor of Chemistry, M.I.T.*	ASSOCIATE SCIENTIST
DR. MANSON BENEDICT, Ph.D. '32, *Professor of Nuclear Engineering, M.I.T*	DIRECTOR
DR. PAUL KRUGER, B.Sc. '50	MANAGER OF DEPARTMENT OF CHEMISTRY
DR. HAROLD RICHTER, Ph.D. '51	SENIOR NUCLEAR CHEMIST
ELI GOODMAN, M.S. '51	CHEMICAL ENGINEER
LEONARD SALTER, B.Sc. '48	NUCLEAR CHEMIST

the endless struggle within their own souls and, in their weariness and discouragement fall under the spell of some specious promise of an external authority that offers an easier way of life. Their faith in freedom, like the seeds that fell upon stony ground and sprang up quickly, has no depth of root; and just because it has no firm hold upon the soil, withers away in the heat of the sun.

If it is not to fail, freedom must be rooted and grounded in the deepest beliefs and convictions of the soul about ultimate things.

Either freedom is one of the things that the very nature of reality itself makes possible, and ultimately necessary; or it is not. If we believe that it is, we have a firm and deep foundation for our confidence in the practicability of gaining and keeping it; if we do not so believe, then all we can do is to tinker at the external and more or less mechanical expressions of a freedom that has no substance and no trustworthy durability. Actually, such a freedom is not worth the effort to win or retain; and much of the cynical, disillusioned defeatism of our time is due to this fact. Only freedom that human reason can regard as inherent in the texture of the universe – or, to put it in simpler terms, only freedom that is implicit in our faith in God – will justify our efforts to make it a living and permanent part of the human enterprise. To prevent the loss of freedom, in our time or in any time, our faith in its value and its availability must be nurtured at every point and reinforced in every crisis by religion.

(*Concluded on page* 520)

ONE of the designs by Samuel Chamberlain'18 for the M.I.T. Wedgwood dinner-service plates. . . . Orders in sets of eight should be placed with the Alumni Office, Room 1-280, M.I.T., Cambridge 39, Mass., for delivery prepaid in the U.S.A. or Canada at the following prices:

On Queen's Ware at $24.50

Limited edition of numbered sets on Bone China at $85.00

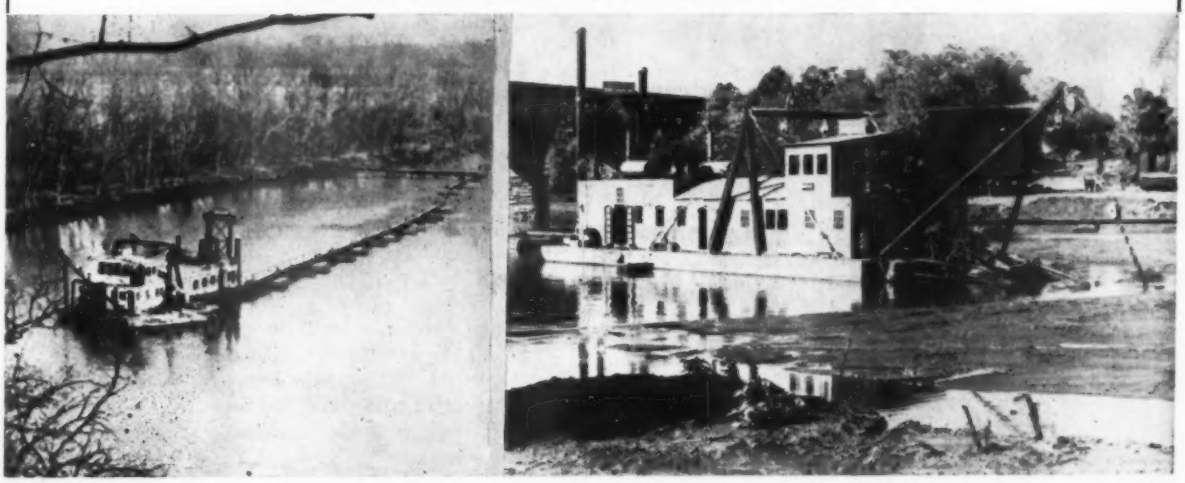
HYDRAULIC DREDGING

PORTABLE STEEL DREDGES – EASILY TRANSPORTED
SPECIALIZING IN RESERVOIRS, RIVERS AND INLAND WATERS
CONSULT US ON YOUR SILTATION PROBLEMS

EASTERN ENGINEERING CO.

C. A. EATON, Pres.—'07

2001 BACHARACH BOULEVARD, ATLANTIC CITY, N. J.



75 years of success

HIGGINS *American Drawing Inks*

1880 1955

DIAMOND JUBILEE

John Gianella '08, Executive Vice President

HIGGINS *Ink Co., Inc.*, Brooklyn, New York

AROUND THE WORLD
FOUNDED 1897

FOUNDATIONS • HEAVY CONSTRUCTION

SOIL INVESTIGATIONS

RAYMOND

CONCRETE PILE COMPANY

NEW YORK BOSTON

and other principal cities

William V. McMenimen '03
VICE CHAIRMAN OF THE BOARD

Stuart E. Bradford '21 *George G. Conway '54*

Reginald H. Burdick Jr. '32 *Warren H. Moses '50*

William A. Conville '52 *Gerald A. O'Connor '29*

Leon H. A. Weaver '19

FREEDOM IS A NOBLE THING

(*Concluded from page* 519)

"By religion;" but if one is to make any such claim for religion, at this point in history and before such a company as is assembled here, it is imperative that one should at least try to make clear in what sense that much misused word is used. Certainly I am not thinking of any *one* of the various forms which religion takes in our modern world. It would be nearer to the truth to say that I am thinking primarily of the faith that is common to *all* the high religions of our time – Judaism, Christianity, Islam, Buddhism, and the others, including that form of religion that used to be called "the religion of all sensible men." But that also is not a real answer to a fair question. Perhaps a few sentences from Professor Paul Tillich's contribution to the Radio Symposium in honor of Columbia University's 200th Anniversary – sentences lifted, I hope not unfairly, from their context – may come closer to a satisfactory answer: "Religion is not a special function of man's spiritual life but it is the dimension of depth in all of its functions." "Religion, in the largest and most basic sense of the word, is ultimate concern." "Religion is the substance, the ground, and the depth of man's spiritual life." And, in the final paragraph of his address, Professor Tillich speaks again of religion's "true place in man's spiritual life, namely, in its depth, out of which it gives substance, ultimate meaning, judgment, and creative courage to all functions of the human spirit."

In some such sense, religion must return to the minds and hearts of educated men if we of this, and the succeeding, generation are not to fail in our efforts to keep the freedom gained for us by our forebears and predecessors, and – if we dare to lift our sights to that great height – possibly enlarge its borders and deepen its hold upon men's souls throughout the world. Freedom, as we have good cause to know, is a fragile thing; but it is also a noble thing. Those who go out into the world today from our universities should be the best-equipped of us all to appreciate its nobility and reinforce its fragility with courage, sound reason, and that ultimate concern which is religion.

Here in the Institute you have been held together in President Killian's words – "by a humane and tolerant spirit of mediation, reconciliation, and reverence for the individual, a community governed by a passion for truth, freedom of inquiry and a preoccupation with ideal aims . . . a community generous in its opportunities to live and let live, a community where men of many faiths and backgrounds are free to interact on each other, a community committed to the ideals of professional service, of ministerings to the public, of advancing learning and creating beauty."

Out of experience in such community all that is essential in a religion adequate to our time can be drawn, if each individual in loyalty to his own inherited faith will allow the broadening and deepening fellowship of the worldwide community, to kindle his imagination and enlist his devotion.

Atlantic
DYESTUFFS

Thiovat
Thioindigoid Vat Colors

Anthravat
Anthraquinone Vat Colors

Atlantic Printing
Stabilized Azoics

Atlantic Resin Fast
For Resin After-Treatment

Direct

Acid

SUPERIOR DYESTUFFS FOR QUALITY TEXTILES

- Uniformity of Shade
- Uniformity of Strength
- Four Convenient Warehouses
- Complete Technical Advisory Service

ATLANTIC
"PRINTING" BLACK 2B POWDER*

Full, bloomy black for use alone or in combination with other stabilized azoics, vat colors, pigments, and soluble vats. Superior light and wash fastness.

ATLANTIC CHEMICAL CORPORATION
MANUFACTURERS OF COAL-TAR INTERMEDIATES AND DYESTUFFS

Executive Offices: **Passaic, N.J. • *Works and Laboratories:* 10 Kingsland Road, Nutley, N.J.**

Bernard Rabinowitz '4

Stocks Maintained at Providence, Rhode Island; Nutley, New Jersey; Greenville, South Carolina and Macon, Georgia.

*Pat. App. For

CABLE ADDRESS: "ANILDYE-PASSAIC"

The Famous

"TECH" DINGHY

DESIGNED AT M.I.T.
FOR REAL SAILING PLEASURE

Here's everything you've always wanted in a small sailboat!

The "Tech" Dinghy was designed several years ago at M.I.T. especially for Fiberglas construction—and designed to provide the utmost in sailing qualities.

Today 40 "Tech" dinghies sail in the M.I.T. fleet—22 other famous colleges have adopted her, as well as many leading yacht clubs and camps.

Whether you are a beginner or an expert, you'll have the time of your life in a "Tech." She is exceptionally fast, instantly responsive, performs well on every point of sailing. Yet she is stable, very simple to handle, has a minimum of parts to lose or break. She is so safe that she will support the whole crew even when awash!

You can always use the "Tech" at a moment's notice, even after leaving it out in the yard all winter. Colors are molded right into the deck and hull. No scraping, caulking or sanding is required. She cannot rot or rust. She does not absorb water, needs no swelling, cannot leak.

Act now and enjoy a full summer of sailing thrills. We can deliver a "Tech" to you immediately.

For complete details, see your local Beetle Dealer or write us direct.

BEETLE BOAT CO., INC., New Bedford, Mass.

Rowboats • Sailboats • Outboards • Cruisers

THE MARCH OF MIND

(*Continued from page 481*)

Yet this is only part of the picture. There remain in the world two main types of political and social organization. One is represented by the parliamentary democracies, in Western Europe, in the British Commonwealth, and in the United States. In economic terms this one is based on the controlled free enterprise (or "capitalist") system. The other is the Communist organization of society based on political regimentation and Marxist economics. The Communists have a theory, that according to the "laws of history," the "capitalist" system will, in the long run, and allowing for periods of what they call co-existence, collapse through its own contradictions. Their mission in life is to hasten this collapse.

We in the West are less addicted to theories of history. But there is plenty of evidence that the advances we have made are in fact mitigating the defects of our society, and gradually bringing about better relations, both between classes within the nations of the Western world, and also between those nations themselves. It is this "position of strength," technical, social and political, which, in the opinion of my government and also yours, has been another factor in bringing the Russians to change their diplomatic approach and, seemingly, to contemplate a reduction of international tension. This position of strength has only been attained by a great deal of hard work in the West, in both the scientific and the political fields, and we shall not long retain it if we persuade ourselves that we have achieved enough now, and can relax our efforts. This is not the only aspect of the competition between the West and the Communist world. Even if our best hopes are realized and we are able to work out arrangements for ensuring a more secure peace, there is no doubt that the eyes of many nations, and particularly those who were recently assembled at the Afro-Asian Conference to which I have referred – the uncommitted third of the world, in fact – are watching the rival merits of the two systems. Which, they ask themselves, is more likely to give them the economic, technological and administrative assistance they need, and provide the pattern for their own development and progress? On the answer that they find to this question, much will depend, including perhaps the balance of power between the Communist and the free worlds.

(*Continued on page 524*)

J. C. CORRIGAN CO., INC.
Conveyors

ENGINEERS—MANUFACTURERS—ERECTORS

•

Portable Conveyors
Conveying Systems and Material Handling Equipment
Coal Handling Systems

Executive Offices
& Plant: 41 Norwood St.
Boston 22, Massachusetts
Tel.: GEneva 6-0800

Branch Sales Office:
420 Lexington Avenue
New York 17, New York
Tel.: LExington 2-9144

CHAS. T. MAIN, INC.

Design of Industrial Plants
Pulp and Paper Mills
Steam, Electrical and Hydraulic Engineering
Machinery Reorganization Water Supply
Investigations, Appraisals and Reports

Boston, Mass. Charlotte, N. C.

CALDWELL-SCOTT
CONSTRUCTION
109 E. 36th St.
New York

NEW YORK
FLORIDA
CARIBBEAN
SOUTH & NORTH AMERICA

GELATIN

All Grades All Types

ATLANTIC GELATIN
Division General Foods Corporation
Woburn, Massachusetts

JOSEPH H. COHEN—'13, *General Manager*

HAROLD ROSENTHAL—'38 BROR GRONDAL—'31, M.S.'32

ALDO C. DI MASCIO—'49 WILLIAM H. BYRON—'42

THE DWIGHT BUILDING COMPANY

General Building Contractors

NEW HAVEN 6, CONNECTICUT

RICHARD C. MACONI 2-'44
Vice President

ALBERT P. LIBBEY '26
Gen. Supt.

G. VINCENT MACONI '15, *President*

The Most Complete
and Modern
Die-Casting Facilities
in New England

Our latest type high pressure Lester Phoenix machines insure precision low-cost castings.

You can depend upon our proven know-how to design and develop your most intricate castings.

Ask to have the Mason representative call, or send us your prints. Our Engineering department will give every request, whether large or small, conscientious prompt attention.

Ted Schwamb '22 Nat Pearlstein '26
Geo. Swift '24 Ed Beaupre '41

L. E. MASON CO.
BOSTON 36, MASS.
Established 1931

THE MARCH OF MIND

(*Continued from page* 522)

Here, then, is a double challenge; to you in the United States, and to us in the British Commonwealth above all others; because we dispose of the greatest resources and influence; because there is, I believe, between us a special bond both in policy and in action. In the first place we must somehow hammer out a sound basis on which the two great opposing groups of powers can live and let live without fear of attack or aggression. Some say that the Communists will never accept such a basis of understanding. But it is and must be our purpose to make the attempt. And it is my opinion that we have in recent months moved a definite and encouraging stage on the long and difficult road to its realization. The other half of the challenge is something which requires no less ingenuity, patience and skill. We must muster the technical and political intelligence, the initiative, and the wisdom, needed to improve our own society, both in its control of material things and in harmonizing the social consequences of this increased control. We must so organize our own economic life and lay out our resources – human, material, intellectual and moral – that our system not only keeps on improving, but will be more satisfying and more worthy of emulation.

This is where the Class of 1955 at M.I.T. comes in. It is not possible any longer to deal with problems such as disarmament and economic development without the closest meshing of political skill with scientific knowledge, of technical proficiency with administrative talent. The first requirement is, of course, to produce a sufficient number of adequately trained people and to achieve this we need a sufficient number of adequately trained teachers. The Soviet Union, and indeed the whole Communist world, does not at present possess the same technological resources, the same numbers of trained people, as does the West. And so they are concentrating great efforts on training the engineers and the scientists they need. They are trying to ensure that, in all fields, but especially in the vital subjects that particularly affect military power, their Institutes of Technology turn out young scientists who will be a match for our own, both in numbers and in ability. Now this is a vital matter for us, and few understand this better than you at M.I.T.

Moreover, today, if the objectives which we have set before us are to be attained, we need not only trained people in sufficient numbers and of good quality: we need more than ever a partnership between the statesman and the scientist, between the technologist and the administrator. Personally, I could not have performed the diplomatic duties which have been laid upon me in the last ten years unless I had acquired at least an elementary knowledge of modern physics and their application. And there is a corollary to this. The scientist and the engineer, in the modern world, needs to have at least a working knowledge of administration, of negotiation, and of politics, while remaining free of course

(*Continued on page* 526)

GERHARDT F. MEYNE COMPANY

BUILDERS

Commercial & Industrial Construction

DONALD W. FETTERS
XVII '32
VICE PRES.

308 W. WASHINGTON ST.
CHICAGO 6, ILL.
FINANCIAL 6-3377

DOUGLAS

Douglas Aircraft Company, Inc.

General Office

Santa Monica, California

The de Florez Company, Inc.

116 East 30th St.

New York, N. Y.

Engineering Development

Processes **Machines**

Luis de Florez '12

Peter de Florez '38

Owen L. Gore '42

Edwin K. Smith '39

Frank J. Anastasio '47

1854 THE KERITE COMPANY 1955

A CORPORATION

SOLE MANUFACTURERS OF KERITE INSULATED WIRES AND CABLES

HIGHEST QUALITY MADE FOR SIGNAL, CONTROL, AND POWER CIRCUITS

Alan S. Dana, M.I.T. '15 — Chief Engineer
Ralph B. Norton, M.I.T. '25 — Asst. Chief Engineer
John B. Gardner, M.I.T. '44 — Engineer
John E. Krantz, M.I.T. '49 — Engineer

General Offices
30 Church Street, New York 7, N.Y.

Factory
Seymour, Connecticut

DEXTER CHEMICAL CORPORATION

Pioneers in the study of static electricity on textiles . . . Specialists in processing agents for cotton, wool and all synthetics.

AZEL W. MACK
New England Sales Manager
M. I. T. 1915

SIDNEY M. EDELSTEIN
Technical Director
M. I. T. 1932

DEXTER CHEMICAL CORPORATION
819 Edgewater Road, New York 59, N. Y.
BOSTON, MASS. ● GREENSBORO, N.C. ● CHARLOTTE, N.C.
ATLANTA, GA. ● BUENOS AIRES

WEBB
electro-mechanical
AUTOMATION

makes the difference
between *ordinary* conveyors
and
HIGH VOLUME PRODUCTION SYSTEMS

J. C. Webb '37
J. D. Rumsey '33
F. K. Haven '23

CONVEYOR ENGINEERS AND MANUFACTURERS
JERVIS B. WEBB COMPANY
8951 ALPINE AVE. DETROIT 4, MICH.
OFFICES IN PRINCIPAL CITIES
FACTORIES IN DETROIT LOS ANGELES HAMILTON, ONT.

THE MARCH OF MIND

(*Continued from page* 524)

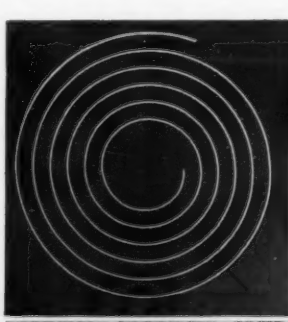
to assert his independence of thought and enquiry. The further the scientific revolution proceeds, the more often scientific questions will form the stuff of international negotiation and national politics. I give, as an example, the conference on the peaceful applications of atomic energy, which is going to meet at Geneva this coming August. Scientists will then foregather to discuss matters which are in form technical and scientific but which will have the most far-reaching political and economic repercussions.

No matter how specialized or how apparently academic the subject matter of an international meeting may be, national prejudices and international frictions lie close beneath the surface. It is the paramount duty of the scientist, as of the diplomatist, in conclave with his colleagues from other countries, to see that they do not break through, or to mitigate the consequences if they do. And here let me warn you against the notion that science is a matter for experts, but that international negotiation is something that any layman can conduct without training.

Ladies and gentlemen, the American or the Englishman today finds his contact with foreign peoples not just in diplomatic, social or business relations, important though these are; but in development work, in the design and execution of great projects overseas, and in what is called technical assistance, especially in the underdeveloped areas of the world. A modern scientist or engineer is just as likely to be summoned to Bangkok or Nairobi as to Pittsburgh or South Bend. And if he is interested in, say, irrigation or hydro-electric power, he will soon learn that the utilization and control of water can be more than a cause of friction between two counties, or even two States of the Union: it can be a major international issue, if the water is that of the Nile, or the Indus, or the Jordan.

Most of you here I believe are graduating from schools of engineering and of science. A particular responsibility will rest upon you as citizens of the most powerful nation in the world. It is for this reason that I want to impress upon you the need, not just for proficiency in your own chosen line, but for awareness of, and participation in, political and economic activities, not only national but international. You may all have your part to play, your con-

(*Concluded on page* 528)



"Precision-Gauged"
HAIRSPRINGS
Manufacturer of all types of hairsprings, with more than 20 years experience making Beryllium Copper Hairsprings for critical instrument applications.

PRECISION PRODUCTS COMPANY INC OF WALTHAM
WALTHAM 54 • • MASSACHUSETTS

"We've found that
Ben really gets there
in an H&D box."
H&D
So does your product...see
HINDE & DAUCH
MANUFACTURERS OF QUALITY CORRUGATED BOXES FOR MORE THAN 50 YEARS • 12 FACTORIES IN THE EAST AND MIDWEST

EMPRESAS FERRE

A Group of Basic Industries Devoted to the Service of All
Industry in Puerto Rico (U.S.A.) and the Caribbean Area

PORTO RICO IRON WORKS, INC.—Ponce, P. R.—San Juan, P. R.
ENGINEERS—Qualified to handle any request on planning design, erection, repair and production.
STEEL FABRICATORS—Facilities to fabricate any type of steel structure.
FOUNDRY—Meehanite, cast iron, bronze, brass, copper, lead, and special alloys.

PONCE CEMENT CORPORATION—Ponce, P. R.
Standard Portland Cement—"Ponce" Brand.

PUERTO RICO CEMENT CORPORATION—San Juan, P. R.
Standard Portland Cement—"Puerto Rico" Brand.

PUERTO RICO CLAY PRODUCTS CORP.—Carolina, P. R.
Structural clay products, Quarry Tile, Bricks, Ceramics.

PUERTO RICO GLASS CORPORATION—San Juan, P. R.
Glass bottles and containers.

DUROTEX CORPORATION—Ponce, P. R.
Asbestos-Cement Products—"DUROTEX" Brand.

PUERTO RICO PULP AND PAPER CORP.—San Juan, P. R.

FERRE EXPORT CORP.—61 Broadway, New York 6, New York.

PONCE PRODUCTS, INC.—160 S. E. Third Ave., Miami, Fla.

A SUS ORDENES, AMIGO

HART PRODUCTS
BASED ON RESEARCH

"Chemicals for Every
Phase of Textile and Leather Processing"

Ralph Hart M.I.T. '15
Morris B. Hart M.I.T. '21
E. I. Birnbaum M.I.T. '30

The Hart Products Corp.
1440 Broadway, New York 18, N. Y.

THE MARCH OF MIND

(*Concluded from page* 526)

tribution to make in these wider fields of human endeavour.

The call is urgent, the need is great. A determined effort is demanded, not only from you here today, but from all those who are graduating this year in science and technology in the United States, in the Universities of Britain, of Canada, and the other nations of the Commonwealth. It is a combined, sustained endeavour at which we must aim.

"Give all thou canst./High Heaven rejects the lore/
Of nicely calculated less or more."

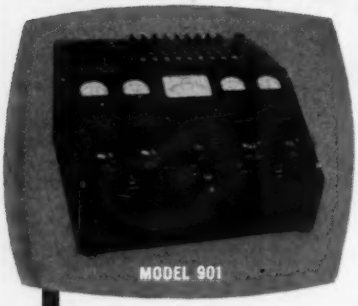
In this spirit let us go forward together to the next phases of the scientific revolution; to the next staging posts on the march of the mind. It is not only in science that we must advance; it is in the application of science to the widening of our horizons, to the elevation of our habits of mind and of thought. We must seek a new synthesis, we must constantly strive to bring our scientific progress into harmony with our social objectives, with our moral and religious values. For it is from these, in the final analysis, that our civilization draws its validity and its strength.

IMPACT ON THE LIFE SCIENCES

(*Concluded from page* 472)

The studies supported by the Atomic Energy Commission at Hiroshima and Nagasaki indicate that there has been no significant change in the percentage of abnormal children born of parents exposed to direct radiation of the atomic bomb. The assurance with which atomic tests can be contemplated is paralleled by the certainty of disastrous genetic effects as well as the other catastrophic effects of a large-scale nuclear war. In the foreseeable peacetime utilization of atomic energy the genetic risk is so slight in relation to other risks as to be disregarded. We must remember, of course, that man has always had available the means of race suicide. It must be our concern to remain strong that our nation which has twice held the control of the world in the hollow of its hand and foreborne to close its fist may continue to be the bulwark of peace and individual freedom.

TRANSCONDUCTANCE ANALYZER AND CIRCUIT SIMULATOR



This direct-reading meter measures transconductance under all operating conditions. It has directly calibrated voltage controls and means for connecting components to simulate the circuitry in which a tube will operate. Facilities are provided for measuring both static and dynamic tube characteristics.

Transconductance Range: 0-100, 0-500, 0-1,000, 0-5,000, 0-10,000, 0-50,000 micromhos. Accuracy of measurement: ±5%.

Write for Catalog

NEW LONDON INSTRUMENT *Company* INC.
82 Union Street
New London 8, Conn.

THE MURRAY PRINTING COMPANY

A Complete Printing Organization
Specializing in Book Reproduction
Manuals and Reports

WAKEFIELD, MASSACHUSETTS

Foreground, DUSTMASTERS. Background, old collectors being removed.

Banister DUSTMASTERS solve large manufacturer's dust problem!

In order to eliminate a dust nuisance and also collect usable product, the company modernized its dust collecting system with Banister DUSTMASTERS. Before replacing the old system, extensive tests were made to determine which equipment would do the job best at a moderate cost.

DUSTMASTERS were selected on the basis of the findings. They have greatly improved product recovery, eliminated a public nuisance, and solved long standing maintenance problems.

Our engineering and manufacturing facilities are at your service. Your inquiries will receive prompt attention. Send for Catalog and material showing how DUSTMASTER Systems solved many so-called impossible dust collecting problems.

A. W. Banister Company, 21 Charles St., Cambridge, Mass.

Gas STANDBY

Packaged 12 mcfh plant designed and built by Draketown for...

- ★ Utility or Industrial standby
- ★ Peak shaving and augmentation
- ★ 100% Town or plant supply

A Packaged Draketown Propane Plant will help you reduce demand charges; provide a supply of gas during curtailment periods... at the turn of a valve... or supply that outlying section or plant 100% if desired.

DRAKETOWN

PROPANE PLANTS

" Good Gas Insurance "

If you have a gas problem, we can help you. We operate from coast to coast and overseas.

Phone or write today—no obligation.

DRAKE & TOWNSEND

Consulting • Design • Engineering • Construction

11 WEST 42ND STREET • NEW YORK 36, N. Y.

GANNETT FLEMING CORDDRY AND CARPENTER, INC.

Engineers

HARRISBURG, PA.

Branch Offices:

Pittsburgh, Pa. **Daytona Beach, Fla.** **Philadelphia, Pa.**

Expressways, Toll Roads, Bridges and Airports. Traffic & Parking. Dams, Water Works, Sewage, Industrial Wastes and Garbage Disposal. Appraisals, Investigations and Reports.

INDUSTRIAL OIL & CHEMICAL COMPANY

Compounders

MILFORD, MASS.

Boston Office
CO 5-8355

Plant
MILFORD 2802

CURTIS A. WHITING '29
Technical Sales Representative

~ SPECIALIZING IN ~

Lubricating, Cutting, Drawing, Stamping and Slushing Oils—Rust Preventives—Sludge Solvents—Fleet Motor Oils—Automotive Specialty Products—Greases

MELPAR

A COMPLETE FACILITY . . . .

has unusual advantages to offer qualified engineers

RESEARCH • DEVELOPMENT • DESIGN • PRODUCTION

- Measuring Techniques and Fundamental Investigations of the Behavior of Mechanical Systems.
- Radioactive Tracer Techniques.
- Instrumentation and Control Devices (servo, pneumatic and electric control).
- Network Theory
- Data Handling Equipment (magnetic cores, magnetic recording equipment, digital computing techniques, analogue to digital conversion shaft digitizers).
- Flight Simulation (servo-mechanisms, pulse circuitry, electronic cabling).
- High Frequency Antennas.
- Audio and Video Circuit Designs.
- Small Mechanisms Design.
- Mechanical Packaging of Electronic Components.
- Design of Reciprocating Compressors, Hot Gas Generators and Diesel Engines.

Please send inquiries for additional information to

DEPT. T.P.101
MELPAR, INC.
452 SWANN AVENUE
ALEXANDRIA, VIRGINIA

452 SWANN AVENUE • ALEXANDRIA, VIRGINIA
11 Galen Street • Watertown, Mass.

A SUBSIDIARY OF THE
WESTINGHOUSE AIR BRAKE COMPANY

Call on Us for

Plasticizers . . . Stabilizers

We're chemical processors producing:

- **PLASTICIZERS** for plastics and rubber
- **STABILIZERS** for plastics

Dudley Clapp, 1910
J. Arthur Hansen, 1934 Everett R. Ackerson, 1941
Charles L. Viola, 1941 Robert H. Wittenauer, 1949

DEECY PRODUCTS CO.
PLASTICIZERS STABILIZERS
120 Potter St., Cambridge 42, Mass.

IMPACT ON OUR WAY OF LIFE

(*Continued from page 475*)

once the case. In this I find no real danger of appeasement without honor. Rather I find hope that men may yet learn to solve their problems without resorting to force. Until this becomes the rule, we must continue to speak with a firmness that is born of the knowledge that we seek justice and peace for all men and backed by the knowledge that if force be needed, we shall not be found wanting. The atom may well be acclaimed the instrument whereby wars are outlawed in the days to come. Fervently we should pray that this becomes a reality.

With respect to our internal economy, it seems clear that the exploitation of the peaceful atom will involve the development of new and significant relationships between government and industry. What these will be no one can say now. But "regulation" and "licensing" are becoming common place words in atomic energy jargon. It is important that the best interests of *all* the people be served in the industrialization of the atom.

Turning to the international scene and the usefulness of the atom as an instrument of foreign policy we find ourselves confronted with an interesting situation. One often hears the question asked – when will power generated through the use of nuclear fuels replace power generated through the use of conventional fuels? The question can be answered rather simply. For a long time to come power will be supplemental power. It will dominate the power field only when it is cheaper than conventional power generation and when the existing power plants are retired from service by reason of age or obsolescence. But in the question there seems to be some suggestion that when atomic power does replace conventional power something new and different will have a great effect on our lives. As a nation, we have utilized power to supplement and to replace the physical exertions of men. Power generated from nuclear fuels will do this just as well but no better than is the case with conventional fuels. Stripped of its glamor, nuclear power will further extend our capacity to substitute mechanical energy for human energy. There can be no question but that nuclear fuel assures the continuation of our type of mass production economy for generations and perhaps centuries to come. And more importantly, it should make

(*Continued on page 532*)

A. J. WOLFE CO.

Electrical Construction

SINCE 1924

2 HARRIS AVE. JAMAICA PLAIN 30, MASS.

Use ELASTIC SHOCK CORDS to take up the slack

A product of many uses, available in many sizes, from ⅛ inch to 1 inch. How can you use it to advantage?

Thomas Taylor & Sons is the largest manufacturer in the world of elastic shock cord, and elastic exerciser cord. We have manufactured large quantities for the armed forces, and are now expanding our domestic markets. Its potentialities stir the imagination.

Elastic Shock Cord is used extensively for tie-downs on trailers, and loads of many types. It is a time-saver, as it eliminates frequent stops for re-adjustment en route. The problem of loads shifting is reduced or eliminated. The cord does not mar the surface.

Elastic Shock Cord is ideal for tent guy ropes. It takes up the slack and holds firm in high winds or gusty weather. It minimizes torn fastenings and loosening of stakes. A loop of elastic shock cord, preferably at the end of each guy rope, will absorb the shocks, and save time in setting up or taking down tents. No adjustment is necessary; merely place the stakes so the elastic cord will be under some tension when slipped over the stake.

Another use is for mooring boats. It allows for tidal or other normal movement and minimizes banging around. Elastic Shock Cord is also ideal for transporting boats, canoes, or racing boats on cars.

THOMAS TAYLOR & SONS
HUDSON, MASS.

ROBERT TAYLOR DAWES
Class of 1926

Reinforced Edge SHOCK CORD
® TAYLORED-TO-FIT

COPR. 1955 THOMAS TAYLOR & SONS

PRECISION DEPTH RECORDER
FOR UNDERWATER SURVEY,
DREDGING AND
OIL EXPLORATION

accuracy ± 3 inches

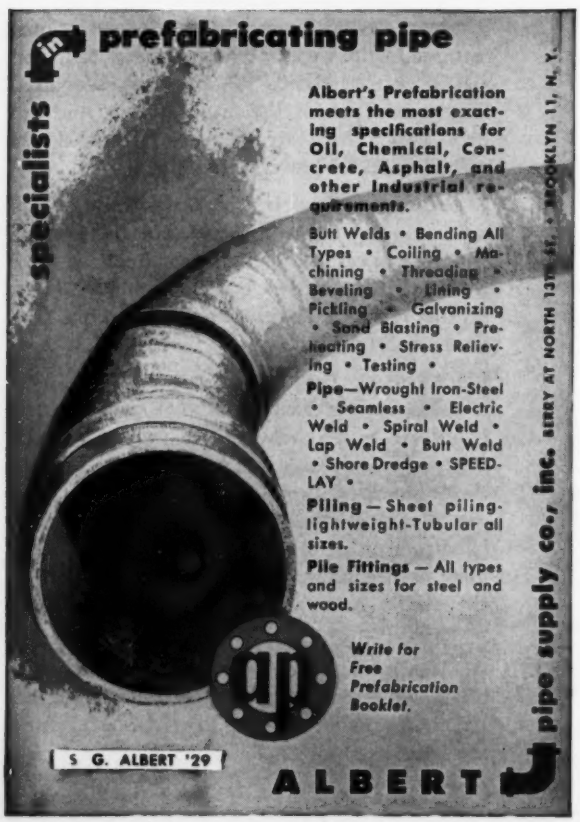
Other precision instruments

RADIOTELEPHONES · DIRECTION FINDERS
RADAR · UNDERWATER METAL LOCATORS

Brochures mailed on request

BLUDWORTH MARINE

A Subsidiary of General Precision Equipment Corp.
92 Gold St., New York 38, N. Y.
W. C. Blaisdell, Vice President
VIA '24


specialists in prefabricating pipe
Albert's Prefabrication meets the most exacting specifications for Oil, Chemical, Concrete, Asphalt, and other Industrial requirements.
Butt Welds • Bending All Types • Coiling • Machining • Threading • Beveling • Lining • Pickling • Galvanizing • Sand Blasting • Preheating • Stress Relieving • Testing •
Pipe—Wrought Iron-Steel • Seamless • Electric Weld • Spiral Weld • Lap Weld • Butt Weld • Shore Dredge • SPEED-LAY •
Piling — Sheet piling-lightweight-Tubular all sizes.
Pile Fittings — All types and sizes for steel and wood.
Write for Free Prefabrication Booklet.
S. G. ALBERT '29
ALBERT pipe supply co., inc. BERRY AT NORTH 13TH ST. • BROOKLYN 11, N. Y.

IMPACT ON OUR WAY OF LIFE

(Continued from page 530)

available to power hungry areas of the world one of the most basic ingredients of a material prosperity.

But are there not other aspects of this matter that should engage our thoughtful attention? If we could export today completely packaged nuclear power plants, would not the availability of such plants to one of the world's backward and power hungry nations gain for us additional friends in the battle for men's minds? At first glance I am sure we would agree that here is a powerful tool for winning the peace. And so it is, but I wonder just how much of the industrial revolution's evolutionary aspects a nation may avoid. The availability of power in itself is not enough. Along with it must go other elements in a machine economy — raw materials, a market for goods, an appreciation of the value of the individual and the desirability of relieving him of tedious, repetitive, degrading work, and most of all, education and development of desire to improve our environment. There is a market here for more than nuclear reactors. The market is for the export and intelligent employment of the best and basic ingredients of our American way of life — freedom, initiative, ingenuity and faith in the individual. A washer and dryer are of no value if hunger stalks the land. There is an awakening of peoples throughout the world to the desire for independence and all that it can mean. We can help and should help such peoples with technological and educational programs — programs aimed at helping them to help themselves — not at telling them that if they will do as we do, their problems will be solved.

But the availability of power from the atom should enable backward peoples to progress as rapidly as their own development as a responsible community will permit. Thus the atom may well prove to be a catalyst of importance to all the world in its singular role of easily transportable power. It appears then that we may possess a unique and powerful instrument of foreign policy.

Perhaps the most honest approach to this subject is to admit that one can only conjecture about the real and lasting effects that atomic energy will have on our way of life. The crystal ball may help some — but of one thing we can be certain — the atom was split by men and the energy thus released will be

(Concluded on page 534)

An Enjoyable Revelation in Pipe Smoking

A M S A N

Absorbs Moisture Sludge and Nicotine

AMSAN pipes look like other pipes but are radically different inside. They need cleaning only about once a month yet they do not have a bad odor either hot or cold. They have no magic or crystals but have a mechanical means of stopping sludge, nicotine, stem drip and that hot, bitter bite from getting to the mouth.

Pipe and Refill—$15.00, postpaid

AMSAN Route 4, Box 1450 Sarasota, Florida

PRIVATE BRAND PACKAGING

Specialists in the packaging of liquids, lotions, pastes, and powders in collapsible tubes, plastic tubes, bottles, jars, cans, packettes, and squeeze bottles.

TUBED CHEMICALS CORPORATION
EASTHAMPTON, MASS.
W. H. Auerswald 2–'46

BLANCHARD CONSTRUCTION CO.

General Contractors

2546 S.W. Vista Ave. Portland 1, Oregon

M. A. Blanchard '36

412 EAST 55th STREET

New York's Newest and Finest Apartment Overlooking Private Tennis Club

12 story building — 1 to 4 Room Apts.

Ready Fall of 1955

Peter Doelger, Incorporated

407 E. 55th St. — N. Y. 22, N. Y.

PLaza 1-1550

W. P. Doelger '26

EUGENE R. EISENBERG, INC.

Contractors *Engineers*

E. R. EISENBERG '43 H. W. EISENBERG '52

30 HUNTINGTON AVENUE BOSTON, MASSACHUSETTS

The TREDENNICK-BILLINGS CO.

Construction Managers *Building Construction*

K. W. RICHARDS '07 H. D. BILLINGS '10 C. C. JONES '12 F. J. CONTI '34

10 HIGH STREET BOSTON, MASSACHUSETTS

HOLMES & NARVER, INC.
ENGINEERS • CONSTRUCTORS

JAMES T. HOLMES
M.I.T. '14
D. LEE NARVER
STANFORD '14

828 S. Figueroa St., Los Angeles 17, California
Telephone TRinity 8201

SYSKA & HENNESSY, INC.
Engineers

DESIGN • CONSULTATION • REPORTS
POWER PLANT • WASTE DISPOSAL • WATER SYSTEMS
New York City

CHAUNCY HALL SCHOOL
Founded 1828. The School that specializes in the preparation of students for the Massachusetts Institute of Technology.
Ray D. Farnsworth, *Principal* 533 Boylston Street, *Boston, Mass.*

LEONARD CONSTRUCTION COMPANY
Engineers and Contractors
SINCE 1905
IN THE AMERICAS AND FAR EAST
37 South Wabash Ave.
Chicago

N. A. LOUGEE & COMPANY
ENGINEERS AND CONSULTANTS
Reports—Appraisals—Depreciation Studies
Rate Cases—Business and Economic Studies
120 BROADWAY NEW YORK 5, N.Y.
N. A. LOUGEE '11 L. A. MATTHEWS '13
J. W. McDONALD, Jr. '20 B. F. THOMAS, Jr. '13
E. S. WEST '40

IMPACT ON OUR WAY OF LIFE

(*Concluded from page* 532)

controlled and directed by men – either for good or for evil. The knowledge that such great destructive power is available already has induced the exercise of patience and diplomacy of a high order in government circles. To maintain the peace – even though it be an uneasy peace – will require that we recognize the increasing interdependence of men and nations economically, socially, and politically. The preparation of men who will meet and discharge the responsibilities of this atomic age is the great challenge to our educational institution today. The evidence that this challenge will be met by your own great institution – Massachusetts Institute of Technology – is both impressive and reassuring.

BENISON FROM FRIENDS

(*Concluded from page* 484)

he does not understand. When thus perceived and carried forward, and when not misused for ignoble ends, science is a major means for present-day Athenians to make gentle the life of mankind. This benign nature of science was eloquently personified by the late Albert Einstein. A skyscraper in the small cluster of towering minds produced by our civilization, he was also a rare human being in his gentleness and his saintliness. Still another scientist who used science superbly to make gentle the lot of mankind was our own Karl Compton.

The concluding wish of this benison and benediction is that you will couple with a resourceful, ambitious career of achievement a moderating sense of the simple satisfaction of running the race. There used to be inscribed above a now-dismantled gateway to an old M.I.T. athletic field these lines of our fellow alumnus, the late Gelett Burgess (who wrote of the purple cow): "Not the Quarry, but the Chase/ Not the Laurel, but the Race/ Not the Hazard, but the Play/ Make Me, Lord, enjoy alway!" In a day when mottoes are out of date and sentiments are inhibited, this inscription still seems good to stand above your gateway from college to a career. With these sentiments of felicitation, affection, and delight, and cherishing your continuing affiliation with this company of scholars, we bid you Godspeed and farewell.

ROTH LABORATORY
FOR PHYSICAL RESEARCH
Serving Industry in these fields –
ELECTRONICS MATHEMATICAL ANALYSIS
AUTOMATION RESEARCH MANAGEMENT
MEDICAL PHYSICS ANALOG COMPUTERS
ULTRASONICS INSTRUMENTATION
DIRECTOR: Wilfred Roth '48
1240 MAIN STREET • JAckson 7-8211
HARTFORD 3, CONNECTICUT

PROFESSIONAL CARDS

JACKSON & MORELAND
Engineers and Consultants

DESIGN AND SUPERVISION OF CONSTRUCTION
REPORTS—EXAMINATIONS—APPRAISALS
MACHINE DESIGN—TECHNICAL PUBLICATIONS

BOSTON NEW YORK

LESSELLS AND ASSOCIATES, INC.
Research—Development—Testing—Consultation
Mechanical Engineering—Mathematical Physics
Electronics
Write for Brochure
916 Commonwealth Avenue Boston 15, Mass.
BEacon 2-2380
P. E. Kyle '39 T. A. Hewson '45 C. H. Kano '43
R. F. Brodrick '48 A. A. Kheiralla '47

EADIE, FREUND AND CAMPBELL
CONSULTING ENGINEERS
500 FIFTH AVENUE NEW YORK 36, N. Y
Mechanical — Electrical — Sanitary
Air Conditioning — Power — Process Layouts
J. K. Campbell, M.I.T. '11

METCALF & EDDY
Engineers
Water, Sewage, Drainage, Refuse and
Industrial Wastes Problems
Airports, Laboratory, Valuations
Statler Building, Boston 16, Mass.

THE KULJIAN CORPORATION
Consultants • Engineers • Constructors
UTILITY • INDUSTRIAL • CHEMICAL
Power Plants (Steam, Hydro, Diesel), Textile Plants,
Water & Sewage Works, Oil Refineries, Pipe Lines,
Army & Navy Installations, Air Fields, Hangars
H. A. Kuljian '19 A. H. Kuljian '48
1200 NO. BROAD ST., PHILADELPHIA 21, PA.

FABRIC RESEARCH LABORATORIES
Incorporated
Research, Development and Consultation
for Textile and Allied Industries
1000 Providence Highway Dedham, Mass.
W. J. HAMBURGER, '21 K. R. FOX, '40 E. R. KASWELL, '39

GILBERT ASSOCIATES, INC.
ENGINEERS • CONSULTANTS • CONSTRUCTORS
607 WASHINGTON ST.
READING, PA.
Malcolm G. Davis '25, *Vice President* Allen W. Reid '12, E. C. Edgar '25
Steam, Hydro, Diesel Power Plants; Industrial Structures;
Plant Safety, Labor Relations, Utility Rates, Valuations,
Reports; Large Scale Purchasing; Industrial Laboratory
New York • Philadelphia • Washington

FAY, SPOFFORD & THORNDIKE
Engineers
John Ayer, '05 Ralph W. Horne, '10
Bion A. Bowman, '09 William L. Hyland, '22
Carroll A. Farwell, '06 Frank L. Lincoln, U. of Me., '25
Howard J. Williams, '20
AIRPORTS — BRIDGES — TURNPIKES
WATER SUPPLY, DRAINAGE AND SEWERAGE
PORT AND TERMINAL WORKS
BOSTON NEW YORK

CLEVERDON, VARNEY & PIKE
Consulting Engineers
HERBERT S. CLEVERDON '10 WALDO F. PIKE '15
Structural Designs Foundations
Heating Ventilating and Plumbing Designs
Industrial Buildings, Reports, Investigations
120 TREMONT STREET BOSTON 8, MASS.

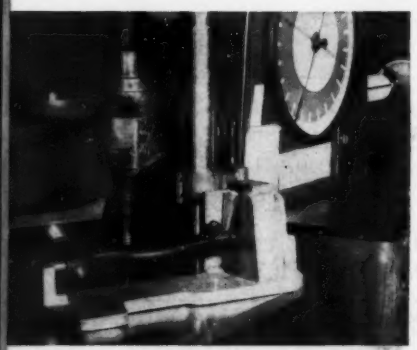
MAURICE A. REIDY
Consulting Engineer
BRIDGES BUILDINGS
STRUCTURAL DESIGNS FOUNDATIONS
CONSTRUCTION CONSULTANT AND ARCHITECTURAL ENGINEER
Estimates and Appraisals
101 TREMONT STREET BOSTON, MASS.

CHARLES NELSON DEBES AND ASSOCIATES
ENGINEERS AND CONSULTANTS
Architectural — Mechanical — Electrical — Structural
Management — Plant Layout — Material Handling
Acoustical
ROCKFORD TRUST BLDG. ROCKFORD, ILL.
C. L. EMERY '32 C. N. DEBES '35 R. S. KNOWLAND '40

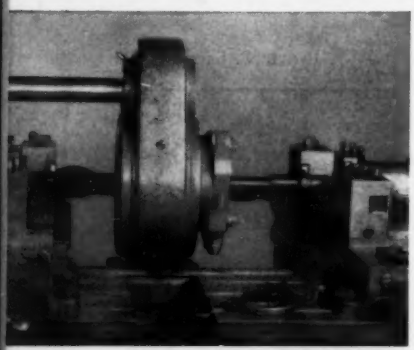
MORAN, PROCTOR, MUESER & RUTLEDGE
CONSULTING ENGINEERS
Foundations for Buildings, Bridges and Dams;
Tunnels, Bulkheads, Marine Structures, Soil Studies and
Tests; Reports, Design and Supervision
WILLIAM H. MUESER '22 PHILIP C. RUTLEDGE '33

GIVEN BREWER
Consulting Engineer
Electric Strain Gage Analysis • *Stress Analysis*
Strain Gage Amplifiers • *Thread Transducers*
MARION, MASS. TEL. 103, 110
G. A. Brewer '38

CAPITOL ENGINEERING CORPORATION
CONSULTING ENGINEERS
Design and Surveys
Roads and Streets
Sewer Systems Water Works
Planning Airports
Bridges • Turnpikes • Dams
Executive Offices
DILLSBURG, PENNSYLVANIA
Dallas, Texas Rochester, N. Y.
Robert E. Smith '41, Vice President



Iron and sample castings are checked daily in Draper Laboratories to meet rigid specifications.



Precision machine tools enable close tolerances to be held.

ACCENT ON QUALITY... FROM START TO FINISH

Attention to detail — all along the line at Draper Corporation — brings you *important savings.*

Engineering developments and manufacturing refinements enable Draper to produce repair parts that have a higher degree of uniformity and quality.

In the mill, these are the repair parts that provide *longer, trouble-free service.*

When you use Draper repair parts exclusively on your looms, increased production, efficiency and profits are assured.

Use of gauges in final inspection per high standards of uniformity and quality be maintained.

DRAPER CORPORATION

HOPEDALE, MASS.

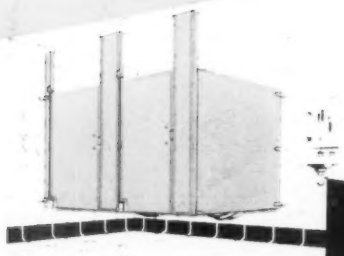
ATLANTA, GA.
GREENSBORO, N. C.
SPARTANBURG, S. C.

"FLU

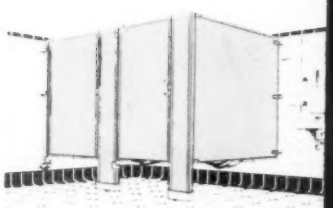
"FLU

FLUS

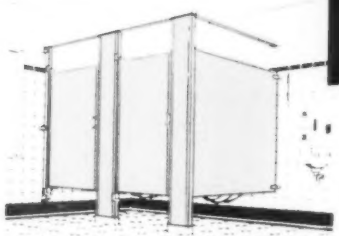
ANE



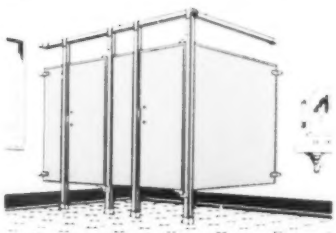
"FLUSHUNG"



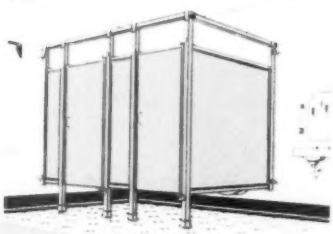
"FLUSHACT"



"FLUSHITE"



"FLUSHMETAL"



"PANELMETAL"

FLUSH-METAL

TOILET COMPARTMENTS

for every type of building

Flush Metal products
functionally designed
to embody strength and beauty.

specialists in construction of

- *toilet compartments*
- *hospital cubicles*
- *shower compartments*

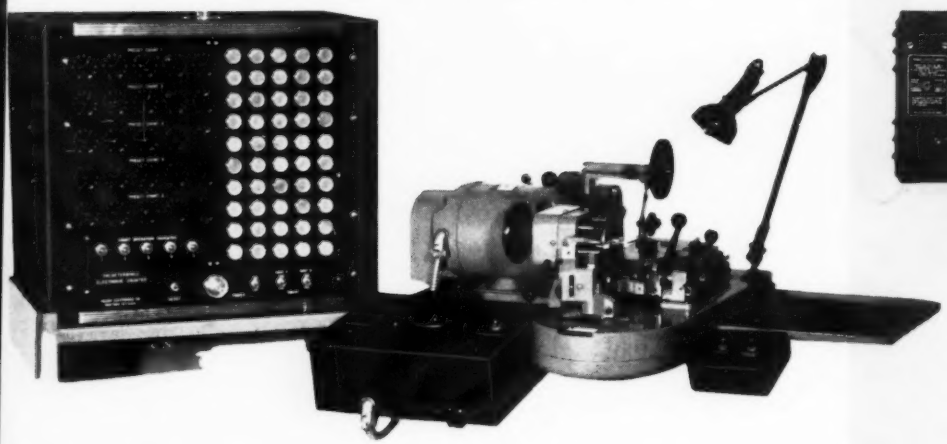
FLUSH-METAL PARTITION CORP.

46-10 11th Street • Long Island City 1, N.Y. • Stillwell 4-3380

Type 1701-A
1/15 hp and less $75.

GR Variac MOTOR SPEED CONTROL

for D-C Motors from A-C Lines



Type 1700-B
1/4 and 1/3 hp. $170.

"...provides good control at all times... smooth operation . . . neat appearance ...is compact in size."

Boesch Manufacturing Company

Type 1702-A
½ and ¾ hp. $245.

The Boesch Manufacturing Company builds the G-R Type 1700-B Variac Motor Speed Control into their precision Toroidal Winder because, in their own words . . .

"With the advent of closer winding specifications, smooth operation is *essential*. We find it extremely helpful to provide slow acceleration and deceleration of the winding speed at start and finish of the operation. This is especially desirable when using lighter wire sizes.

"The General Radio Motor Control is used to control the shuttle speed on our machine. It provides excellent control at all times on this operation and holds speed steady at a given setting. The dynamic braking action is also highly desirable, especially where the core loop counter is used. Here dynamic braking provides for a minimum runover of turns.

"The Control is compact in size and presents a neat appearance which fits well into the overall design of our Winder."

Type 1703-A
1/12 to 1/6 hp. $97.50.

VARIAC Motor Speed Controls are available in a wide variety of sizes from 1/15 hp to 1½ hp. Prices are from $75 to $495. Where a manufacturer wishes to combine this control with his equipment in his own cabinet, the basic elements can be provided as a sub-assembly.

Type 1705-A
1½ hp. $495.

Write For More Information

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U.S.A.

90 West St. **NEW YORK 6**
920 S. Michigan Ave. **CHICAGO 5**
1000 N. Seward St. **LOS ANGELES 38**
8055 13th St., Silver Spring, Md. **WASHINGTON, D. C.**

OL

700-B
$170.